NAT'L INST. OF STAND & TECH REC.
A11104 713079
NIST
PUBLICATIONS

REFERENCE

NVLAP®

National
Voluntary
Laboratory
Accreditation
Program

Electromagnetic Compatibility and Telecommunications

FCC Methods

Eric R. Lindstrom
Jeffrey Horlick

NIST HANDBOOK 150-11

U.S. Department of Commerce
Technology Administration
National Institute of Standards
and Technology

QC
100
.U51
NO.150-11
1995

The National Institute of Standards and Technology was established in 1988 by Congress to "assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries."

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry's competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency's basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department's Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST's research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Public Inquiries Desk, 301-975-3058.

Office of the Director
- Advanced Technology Program
- Quality Programs
- International and Academic Affairs

Technology Services
- Manufacturing Extension Partnership
- Standards Services
- Technology Commercialization
- Measurement Services
- Technology Evaluation and Assessment
- Information Services

Materials Science and Engineering Laboratory
- Intelligent Processing of Materials
- Ceramics
- Materials Reliability[1]
- Polymers
- Metallurgy
- Reactor Radiation

Chemical Science and Technology Laboratory
- Biotechnology
- Chemical Kinetics and Thermodynamics
- Analytical Chemical Research
- Process Measurements[2]
- Surface and Microanalysis Science
- Thermophysics[2]

Physics Laboratory
- Electron and Optical Physics
- Atomic Physics
- Molecular Physics
- Radiometric Physics
- Quantum Metrology
- Ionizing Radiation
- Time and Frequency[1]
- Quantum Physics[1]

Manufacturing Engineering Laboratory
- Precision Engineering
- Automated Production Technology
- Intelligent Systems
- Manufacturing Systems Integration
- Fabrication Technology

Electronics and Electrical Engineering Laboratory
- Microelectronics
- Law Enforcement Standards
- Electricity
- Semiconductor Electronics
- Electromagnetic Fields[1]
- Electromagnetic Technology[1]
- Optoelectronics[1]

Building and Fire Research Laboratory
- Structures
- Building Materials
- Building Environment
- Fire Safety
- Fire Science

Computer Systems Laboratory
- Office of Enterprise Integration
- Information Systems Engineering
- Systems and Software Technology
- Computer Security
- Systems and Network Architecture
- Advanced Systems

Computing and Applied Mathematics Laboratory
- Applied and Computational Mathematics[2]
- Statistical Engineering[2]
- Scientific Computing Environments[2]
- Computer Services
- Computer Systems and Communications[2]
- Information Systems

[1] At Boulder, CO 80303.
[2] Some elements at Boulder, CO 80303.

NIST HANDBOOK 150-11

National Voluntary Laboratory Accreditation Program

Electromagnetic Compatibility and Telecommunications

FCC Methods

Eric R. Lindstrom
Jeffrey Horlick

April 1995

U.S. Department of Commerce
Ronald H. Brown, Secretary

Technology Administration
Mary L. Good, Under Secretary for Technology

National Institute of Standards and Technology
Arati Prabhakar, Director

National Institute of Standards and Technology
NIST Handbook 150–11
108 pages (April 1995)
CODEN: NIHAE2

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1995

For sale by the Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

NVLAP AND THE NVLAP LOGO

The term NVLAP and the NVLAP logo are Federally registered trademarks of the National Institute of Standards and Technology and the Federal Government, who retain exclusive rights therein. Permission to use the term and/or the logo is granted to NVLAP-accredited laboratories for the limited purposes of announcing their accredited status, and for use on reports that describe only testing and calibration within the scope of accreditation. NIST reserves the right to control the quality of the use of the term NVLAP and of the logo itself.

PREFACE

NIST Handbook 150-11 presents the technical requirements of the National Voluntary Laboratory Accreditation Program (NVLAP) for accreditation under the Electromagnetic Compatibility and Telecommunications (ECT) LAP. There are two program handbooks for the ECT LAP. This handbook covers test methods used to demonstrate compliance with FCC requirements given in Title 47 of the U.S. Code of Federal Regulations (CFR), Telecommunication, Part 15, Digital Devices, and FCC Part 68, Analog and Digital. A second program handbook, NIST Handbook 150-14, describes the requirements for test methods in Military Standards 461/462, Electromagnetic Compatibility. Program handbooks are intended for information and use by staff of accredited laboratories and laboratories seeking accreditation, other laboratory accreditation systems, users of laboratory services, and others needing information on the requirements for accreditation.

This publication supplements NIST Handbook 150, *NVLAP Procedures and General Requirements*, which contains Part 285 of Title 15 of the U.S. Code of Federal Regulations (CFR) plus all general NVLAP procedures, criteria, and policies. The criteria in NIST Handbook 150 encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987). Handbook 150-11 contains information that is specific to the FCC Part 15 and Part 68 test methods and does not duplicate information contained in the Procedures and General Requirements.

The numbering of the sections of this handbook is patterned after Handbook 150; for example, Section 285.3 of Handbook 150 presents the description and goal of NVLAP, whereas Section 285.3 of Handbook 150-11 presents the description of the ECT Program for FCC test methods. Where there is no program specific information, the section number is omitted.

Questions or comments on this handbook should be submitted to the National Institute of Standards and Technology/NVLAP, Building 411, Room A162, Gaithersburg, MD 20899; phone (301) 975-4016; fax (301) 926-2884; e-mail NVLAP@enh.nist.gov.

ACKNOWLEDGMENTS

The authors acknowledge with thanks the contributions of David Staggs, Mac Plante, and Edson Hineline for developing and reviewing the specific checklists, and the NVLAP Technical Experts (TEs) for their valuable comments and suggestions over the years. Recognition is also extended to the FCC staff members in Washington, DC and at the laboratory in Columbia, MD.

Special thanks to Vanda White, current editor of the handbook series. The NVLAP Program Handbook series, which began in 1982, comprises the combined efforts of the entire NVLAP staff, both past and present.

TABLE OF CONTENTS

PREFACE iii

ACKNOWLEDGMENTS iv

SUMMARY vi

Sec. 285.1 Purpose 1

Sec. 285.2 Organization of procedures 1

Sec. 285.3 Description of the NVLAP ECT Program for FCC test methods 1

Sec. 285.4 References 1

Sec. 285.5 Definitions 2

Sec. 285.6 NVLAP documentation 3

Sec. 285.22 Assessing and evaluating a laboratory 4

Sec. 285.23 Granting and renewing accreditation 6

Sec. 285.33 Criteria for accreditation 6
- (b) Organization and management 6
- (c) Quality system, audit and review 6
- (d) Personnel 7
- (e) Accommodation and environment 7
- (f) Equipment and reference materials 8
- (g) Measurement traceability and calibration 8
- (h) Calibration and test methods 9
- (i) Handling of calibration and test items 9
- (j) Records 9
- (k) Certificates and reports 10

APPENDICES
- SAMPLE ACCREDITATION DOCUMENTS A-1
- GENERAL OPERATIONS CHECKLIST B-1
- SPECIFIC OPERATIONS CHECKLIST - FCC PART 15-DIGITAL DEVICES C-1
- SPECIFIC OPERATIONS CHECKLIST - FACILITY LISTING WITH FCC D-1
- SPECIFIC OPERATIONS CHECKLIST - FCC PART 68-ANALOG AND DIGITAL E-1
- PROGRAM-SPECIFIC APPLICATION FORM F-1

SUMMARY

Any laboratory (including commercial, manufacturer, university, federal, state, or local government laboratory) that performs test methods listed in this document may apply for NVLAP accreditation. Accreditation will be granted to a laboratory that complies with the conditions for accreditation as defined in the NVLAP Procedures. Accreditation does not mean a guarantee of laboratory performance or of product test data—it is a finding of laboratory competence. The names of NVLAP-accredited laboratories are published in the NVLAP annual directory and other media to which information is regularly provided.

The NVLAP ECT Program for FCC test methods was established in October 1985, in response to a request from five private-sector testing laboratories. The purpose of the program is to formally recognize laboratories found competent to perform testing in accordance with 47 CFR Part 15-Digital Devices and 47 CFR Part 68-Analog and Digital.

Testing methods covered: Testing of devices and equipment for conformance to FCC Part 15-Digital Devices and FCC Part 68-Analog and Digital (see Appendix F).

Period of accreditation: One year, renewable annually.

On-site assessment: Visit by a technical expert(s) to determine compliance with the NVLAP criteria before initial accreditation and every two years thereafter. Monitoring visits as required.

Assessors: Technical experts with experience in the appropriate field(s) of testing.

Proficiency testing: Laboratories may be sent test samples or artifacts, data sheets, and an information package containing instructions for preparation, conditioning, configuring, and testing. The completed test report is sent to NVLAP for analysis. Advance notice and instructions are given before proficiency testing is scheduled.

Granting accreditation: Based upon satisfactory on-site assessment and resolution of deficiencies, proficiency testing, and technical evaluation of applicable laboratory information.

Fees: Payments are required as listed on the NVLAP fee schedule, including the administrative/technical support fee, on-site assessment fee, and test method fee.

Sec. 285.1 Purpose

The purpose of this handbook is to set out procedures and technical requirements for NVLAP accreditation of laboratories which perform tests in accordance with FCC Part 15-Digital Devices and FCC Part 68-Analog and Digital. It complements and supplements the NVLAP program procedures and general requirements found in NIST Handbook 150.

The interpretive comments and additional requirements contained in this handbook make the general NVLAP criteria specifically applicable to the ECT program test methods listed. The quality system requirements are designed to comply with the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002.

Sec. 285.2 Organization of procedures

(a) The numbering of the sections of this handbook is patterned after NIST Handbook 150, *NVLAP Procedures and General Requirements*, to allow easy cross-reference.

(b) The procedures and general requirements of NIST Handbook 150 and the interpretations and specific requirements in this handbook must be combined to produce the criteria for accreditation in the NVLAP ECT Program for FCC test methods.

(c) This handbook contains appendices which supplement the text:

(1) Appendix A provides examples of a NVLAP Certificate of Accreditation and a Scope of Accreditation for the ECT Program for FCC test methods;

(2) Appendix B provides the General Operations Checklist which NVLAP assessors use during an on-site technical assessment to evaluate a laboratory's ability to conduct testing in general;

(3) Appendix C provides the Specific Operations Checklist which is used by NVLAP assessors during on-site assessments of a laboratory which conducts tests to FCC Part 15 requirements for Digital Devices;

(4) Appendix D provides the Specific Operations Checklist concerning the basic requirements for a test facility;

(5) Appendix E provides the Specific Operations Checklist which NVLAP assessors use during an on-site assessment of a laboratory which conducts FCC Part 68 test methods; and

(6) Appendix F contains the program-specific application form, including the Test Method Selection List.

Sec. 285.3 Description of the NVLAP ECT Program for FCC test methods

This program was established in response to a request from private sector testing laboratories. The purpose of this program is to accredit testing laboratories found capable and competent to perform conformance testing to FCC Part 15-Digital Devices, FCC Part 68-Analog and Digital, and other test method standards that may be added to the program.

The standards covered by this program handbook are divided into two parts: 1) test methods for the measurement of radiated and conducted emissions from Digital Devices according to FCC Part 15, and 2) test methods for the determination of compatibility of Terminal Equipment with respect to the user and the Public Switched Telephone Network, and the compatibility of telephone handsets with hearing aids under FCC Part 68. The test method selection list is contained in Appendix F.

Sec. 285.4 References

Reference documents, standards, and publications for this program and their sources are given below.

(a) NVLAP publications

(1) NIST Handbook 150, *NVLAP Procedures and General Requirements*; and

(2) NIST Special Publication 810, 1995 edition, *NVLAP 1995 Directory*.

NVLAP publications may be ordered from:

NIST/NVLAP
Building 411, Room A162
Gaithersburg, MD 20899

Phone: (301) 975-4016
Fax: (301) 926-2884
e-mail: NVLAP@enh.nist.gov

(b) U.S. Government Printing Office (GPO) documents

(1) Part 15-Radio Frequency Devices as found in Title 47 CFR-Telecommunication, Parts 0 to 19; and

(2) Part 68-Connection of Terminal Equipment to the Telephone Network as found in Title 47 CFR-Telecommunication, Parts 40 to 69.

U.S. GPO documents may be ordered from:

U.S. Government Printing Office
Superintendent of Documents
Mail Stop: SSOP
Washington, DC 20402-9328.

(c) Institute of Electrical and Electronics Engineers (IEEE) standards and related documents

(1) ANSI C63.4-1992 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz;

(2) ANSI C63.5 American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electromagnetic Interference (EMI) Control;

(3) ANSI C63.6 American National Standard for the Computation of Errors in Open-Area Test Site Measurements; and

(4) ANSI C63.7 American National Standard for Construction of Open Area Test Sites for Performing Radiated Emission Measurements.

These documents may be ordered from:

Institute of Electrical and Electronics Engineers
445 Hoes Lane, P.O. Box 1331
Piscataway, NJ 08855-1331

Order Phone: (800) 678-4333
Fax: (908) 981-9667.

(d) Telecommunications Industry Association (TIA)/EIA Bulletin TSB31-A, "Part 68 Rationale and Measurement Guidelines"; available from:

Telecommunications Industry Association
2500 Wilson Boulevard, Suite 300
Arlington, VA 22201

Phone: (703) 907-7700
Fax: (703) 907-7727.

(e) Federal Communications Commission (FCC) documents

(1) Form 730, Application Guide-Registration of Telephone and Data Equipment;

(2) Form 731, Application for Equipment Authorization;

(3) OET Bulletin No. 61, The FCC Equipment Authorization Program for Radio Frequency Devices, Dec. 1993; and

(4) OET Bulletin No. 62, Understanding the FCC Regulations for Computers and Other Digital Devices, Dec. 1993.

These documents may be ordered from:

FCC
Forms Distribution Center
2803 52nd Ave.
Hyattsville, MD 20781

Phone: (202) 418-3676.

Sec. 285.5 Definitions

Certification: A process to attest that a product is in conformance with a specific standard as determined through use of a specified test method.

Conformance: The state of an implementation satisfying the requirements and specifications of a specific standard as tested by a test suite.

Conformance testing: The testing of an implementation against the requirements specified in one or more standards.

Digital device: An information technology equipment (ITE) that falls into the class of unintentional radiators that uses digital techniques and generates and uses timing signals or pulses at a rate in excess of 9000 pulses per second.

Electromagnetic compatibility (EMC): The ability of a device, equipment, or system to function

satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

Equipment under test (EUT) (radio-noise emission): A device or system used for evaluation that is representative of a product to be marketed.

Harm: Electrical hazards to telephone company personnel, damage to telephone company equipment, malfunction of telephone company billing equipment, and degradation of service to persons other than the user of the subject terminal equipment, his calling or called party.

Public switched telephone network (PSTN): A telephone network in which connections are established as and when required and that is supplied, operated, and controlled by one or more telecommunications operating companies to provide telephone service that is available to the public.

Quality assurance: All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

Quality control: The operational techniques and activities that are used to fulfill requirements for quality.

Unintentional radiator: A device that generates radio-frequency energy for use within the device, or sends radio-frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit radio-frequency energy by radiation or induction.

Sec. 285.6 NVLAP documentation

(a) Handbooks

(1) The NVLAP procedures and general requirements are contained in NIST Handbook 150. NIST Handbook 150 is used for all NVLAP testing laboratory and calibration laboratory programs. The portions of NIST Handbook 150 marked with a triangle in the margin do not generally apply to the ECT Program; they concern calibration laboratories.

The general terms used in NIST Handbook 150 are interpreted, expanded, and detailed in the program-specific handbooks.

(2) The technical procedures and program-specific requirements for FCC test methods are contained in this handbook.

(b) NVLAP Checklists

(1) Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation. Checklists are filled out during the on-site assessment, discussed during the exit briefing, signed by the laboratory representative and the assessor, and a copy is given to the laboratory. The checklists become part of the laboratory history kept by NVLAP.

(2) NVLAP programs incorporate two types of checklists:

(i) The NVLAP General Operations Checklist addresses factors applicable to evaluating a laboratory's ability to conduct testing in accordance with the procedures and general requirements for accreditation. The factors include, but are not limited to, the laboratory's organization, management, and quality system in addition to its testing competency.

The General Operations Checklist, presented in Appendix B, is numbered to correspond to the requirements in NIST Handbook 150.

(ii) The Specific Operations Checklists, presented in Appendices C, D, and E, are specific to the ECT Program for FCC test methods, focus on the testing requirements, and include the assessor's observations of test demonstrations. These checklists may be revised when appropriate to reflect changes in the technical requirements, scope, and/or technology of the program.

(3) Each of the checklists ends with a comments and deficiencies form. The assessor uses these forms to explicitly identify and describe deficiencies noted in the body of the checklists. Additionally, the assessor may use the form to document comments on any aspect of the laboratory or its performance.

Sec. 285.22 Assessing and evaluating a laboratory

(a) On-Site Assessment

(1) The on-site assessment for this program will most likely be performed by one or two NVLAP assessors in one day plus the following morning. All observations made by the assessors are held in strictest confidence.

The assessor(s) will make advance arrangements for the on-site assessment of a laboratory and will discuss the duration of the visit. The quality manual should be sent to the assessor for review in advance of the assessment.

The laboratory should be in good order and personnel should be prepared to demonstrate testing. The demonstrations can be made on laboratory artifacts, artifacts provided by the assessor, or the assessor can observe work in progress for a laboratory client. The assessor will try to minimize disruption to the normal working routine.

The assessor will use the NVLAP General Operations checklist and the applicable Specific Operations checklist(s). The checklists serve to ensure a complete assessment and that all assessors cover the same items at each laboratory. The checklists contain questions to cover all possible assessment issues, both general and specific; however, not all questions will apply in all circumstances. Also, the assessor may delve more deeply into checklist items as necessary.

The assessor will need to take breaks during the visit to fill in the NVLAP checklists and to prepare the On-site Assessment Report.

(2) The agenda for a typical on-site assessment follows:

(i) The assessor(s) meets with the Authorized Representative or designee, laboratory management, supervisory personnel, and selected staff to explain the purpose of the on-site assessment and to discuss the schedule for the assessment activities. Information provided by the laboratory on its NVLAP application forms may be discussed during this meeting.

The laboratory manager decides which staff members attend the meeting.

The assessor will ask the laboratory manager to assist in arranging times for interviews with laboratory key staff members. While it is not necessary for the assessor to talk to all of the staff members, he/she may select staff members representing all aspects of the laboratory.

(ii) The assessor reviews laboratory documentation, including the quality system documents, quality manual, equipment records including calibration and maintenance, test procedures, test reports, personnel competency records, and personnel training plans and records.

Although there must be a laboratory staff member available to answer questions, the assessor may wish to review the documents alone. The assessor does not usually ask to remove any documents from the laboratory.

The assessor will check personnel information for job descriptions, résumés, and technical performance reviews. The assessor need not be given information which violates individual privacy such as salary, medical information, or performance reviews outside the scope of the laboratory's accreditation. At the discretion of the laboratory, a member of its human resources department may be present during the review of personnel information.

(iii) The assessor evaluates equipment and facilities for appropriateness, capability, adherence to specification, etc. at the laboratory site and, if appropriate, at the test site.

Laboratory staff members should be available to demonstrate equipment and to answer questions.

(iv) The assessor observes the demonstration of selected procedures and interviews the engineer(s) and/or technician(s).

For Part 15-Digital Devices, the demonstrations should include the use of receivers and/or spectrum analyzers in shielded enclosures and pre-scan areas.

For Part 68-Analog and Digital, an appropriate test artifact is needed to demonstrate the test equipment. Both automatic and manual systems are evaluated. The Hearing Aid Compatibility test setup must be operable.

(v) The assessor physically examines equipment and facilities. This includes storage areas, shielded enclosures, open area test sites, anechoic chambers, pre-scan areas, test benches, electronics, test jigs, and antennas, as appropriate.

For Part 15-Digital Devices, the laboratory must provide transportation to open area test sites for the assessor. The assessor examines the open area test site, observes a demonstration of the facility, and reviews site attenuation data. If the laboratory maintains more than one open area test site, the assessor will ask questions to determine whether all sites are operated and equipped in the same manner. Usually one site will be examined, however at the discretion of the assessor, more than one site may be examined.

(vi) At the end of the on-site assessment, an exit briefing is held with the laboratory manager and staff to discuss the assessor's findings.

Comments not identified as deficiencies by the assessors should be given serious consideration, but are taken at the laboratory's discretion. Any disagreements between the laboratory and the assessor should be referred to NVLAP for further evaluation.

At the conclusion of the exit briefing, the laboratory Authorized Representative (or designee) and the assessor both sign the On-Site Assessment Report and the checklists. A copy of the report and of the checklists is given to the laboratory.

(b) Proficiency Testing

(1) The proficiency testing program may be conducted by NVLAP or by a NVLAP-approved contract laboratory. The proficiency testing artifacts will test the laboratory's ability to follow the test method and to achieve the proper accuracy, precision, and detection limits.

(2) Each laboratory will be sent test artifacts, data sheets, and instructions for performing the test and reporting the results. The test shall be conducted in accordance with the specific test method using the laboratory's normal operating procedures. Proficiency testing shall not be contracted out to another laboratory. Any special NVLAP instructions shall also be followed. The special instructions are designed to ensure uniformity in procedures among participants. Completed data sheets shall be returned to NVLAP or its designated contractor for analysis by the date specified on the data sheets. Failure to return the proficiency testing data sheets by the deadline date will result in penalties which may include failing that round.

(3) Proficiency testing may involve materials or artifacts that must be returned to NVLAP for use by other participants. These materials shall be protected from damage both in the laboratory and during shipment back to NVLAP or its designated contractor. Some of the test artifacts used in this program may be one-of-a-kind items. After testing they must be returned to NVLAP for use by other participants. Examples of artifacts are: a computing device with or without peripherals for Part 15, a commercially procured terminal device for Part 68, and "black boxes" for either part. "Black boxes" may be used to determine testing performance for specific subparts of the test methods.

(4) The results of the proficiency testing program will be reported to the participants and in appropriate documents and reports. The identity and performance of individual laboratories will remain confidential. The results of proficiency testing will be made available to on-site assessors for use during laboratory visits. Any problems indicated by proficiency testing will be discussed with appropriate laboratory personnel, who will then be responsible for developing and implementing plans for resolving the problems. Accreditation

decisions will be based on satisfactory resolution of proficiency testing deficiencies.

Sec. 285.23 Granting and renewing accreditation

Laboratories granted NVLAP accreditation are provided with two documents: a Certificate of Accreditation and a Scope of Accreditation. Samples of these accreditation documents for the ECT Program are shown in Appendix A.

Sec. 285.33 Criteria for accreditation

(b) Organization and management

The conditions for continued accreditation of a sub-facility for this program are contained in this section.

(1) As stated in Sec. 285.5 of NIST Handbook 150, *Definitions*: "NVLAP previously differentiated between *main facilities* and *sub-facilities*. This distinction is no longer recognized. (Exception: As long as there is no break in accreditation, any laboratory previously accredited as a sub-facility may request to be 'grandfathered' in its accreditation renewal under the former classification as a sub-facility, including the unique conditions associated with that classification.)"

(2) Main laboratory facilities and sub-facilities are defined as follows:

(i) A *main laboratory facility* permanently maintains staff, equipment, procedures, documentation, and facilities necessary to perform the tests for which it seeks accreditation; implements all quality assurance procedures; and maintains and retains all records, and issues test reports.

(ii) A *sub-facility* is physically separate from, but considered an extension of, the main facility. Although it may have all staff, equipment, procedures, and documentation necessary to perform the requisite tests, it receives technical direction and quality management from the main facility. A sub-facility shall maintain staff, equipment, procedures, documentation, and facilities necessary to perform the tests for which it seeks accreditation.

(3) NVLAP will renew the accreditation of a sub-facility (in addition to the main facility) if:

(i) the laboratory was accredited as a sub-facility prior to October 1, 1993;

(ii) the laboratory main facility meets all NVLAP accreditation criteria;

(iii) the laboratory main facility satisfactorily documents and maintains quality assurance procedures addressing the applicable sub-facility; and

(iv) the sub-facility complies with all applicable NVLAP criteria.

(4) NVLAP requires that sub-facilities undergo on-site assessments.

(c) Quality system, audit and review

(1) The laboratory shall define quality objectives for ensuring accurate and precise test data. These objectives should be the benchmark by which the laboratory management assesses overall and individual performance.

(2) Under its quality system, the laboratory shall develop and implement procedures covering all the technical requirements of this handbook. Periodic reviews of the quality system by the laboratory shall reflect adherence to NVLAP requirements and the laboratory's quality objectives. These reviews should reflect positive aspects of the quality system as well as deficiencies.

Laboratory test personnel should be able to obtain enough information from the laboratory's quality documentation to perform their work in the absence of the laboratory manager. Specific evidence that all staff members have been trained for their role in the quality assurance program is required.

(3) The most recent editions of the documents listed in Sec. 285.4 *References* shall be available as references in maintaining the quality system. There shall, also, be available in the laboratory general reference texts on statistics and quality assurance.

(d) Personnel

(1) The laboratory shall maintain complete position descriptions and qualification requirements for all technical positions. These should include engineering and testing positions (i.e., Sr. EMI Technician, Jr. EMI Test Engineer, etc.). There shall also be on file a listing of staff members assigned to those positions. This listing should be by job function and position (i.e., management, engineering, etc.). Also, the laboratory should maintain a résumé for all technical and other key staff.

(2) For each staff member, the laboratory shall maintain records which include: a résumé of qualifications, training, laboratory procedures to which assigned, and the results of periodic competency and performance reviews. The staff information may be kept in the laboratory's official personnel folders or in separate, official folders that contain only the information that the NVLAP assessor(s) needs to review.

(3) The laboratory must assure that test personnel and technical supervisors have adequate qualifications and training to conduct appropriate tests. The laboratory shall have a detailed documented description of its training program for new and current staff members. New staff members shall be trained for the testing duties assigned and staff members shall be retrained when they are assigned new responsibilities or when test methods and equipment are changed. Each staff member must receive training for assigned testing duties either through on-the-job training or formal classroom sessions.

(4) The laboratory shall evaluate the competency of each staff member either through observation(s) of performance, or an oral or written examination for each test method the staff member is authorized to conduct. Competency reviews of staff members may include intra-operator tests, inter-operator tests, and between-laboratory tests. An observation and an evaluation of performance must be conducted annually by the immediate supervisor or a designee appointed by the laboratory director. A record of the annual evaluation of each staff member must be dated and signed by the supervisor and the employee. Competency review policies and procedures shall be contained in the quality system documentation.

(5) Appropriate reference documents, texts and current scientific and industry periodicals shall be made available to all staff members to keep their knowledge up to date.

(e) Accommodation and environment

(1) The laboratory shall have adequate facilities to meet requirements for NVLAP accreditation. This includes adequate space to perform the testing, environmental controls, adequate testing equipment, and either properly calibrated laboratory standards or access to the services of a competent calibration laboratory.

(2) Part 15-Digital Devices: A facility layout plan of the laboratory including a complete description of the laboratory's open area test site, including drawings and descriptions of the surrounding area and adjacent structures if applicable. If a facility other than an open area test site is used, a complete description is required along with documentation of equivalence. The laboratory's submission to the FCC Description of Measurement Facilities Program must be documented.

The test facility should be operational and available for inspection during the on-site visit. The site attenuation should be checked per ANSI C63.4 at least once per year and complete written records should be maintained. The site attenuation should also be checked if significant changes are made in or near the open area site. This information will be reviewed during the visit.

(3) FCC Part 68-Analog and Digital: The laboratory should have a procedure for daily checkout of the testing system before use. This is especially important for automated systems. The laboratory should have at least one telephone device reserved for use in periodic checks of the test system.

The waveform of the surge generator should be checked with an oscilloscope at least once per year and photographs of the waveform should be kept on file.

A laboratory can be accredited for Part 68.312, vibration and temperature, if it has the test equipment. The range of vibration and temperature that is offered to the client shall be documented.

(f) Equipment and reference materials

(1) The laboratory shall be furnished with the equipment necessary for the performance of the tests and measurements for which it is accredited.

(2) An accredited laboratory must provide and maintain a complete listing of applicable test instrumentation. The list should include model number, serial number, manufacturer, and applicable range (e.g., 14 kHz to 1 GHz, 0-300 V DC, etc.)

(3) Broadband antennas that are used for final radiated emissions testing should be calibrated once per year. These calibrations can be made by the laboratory if the proper procedures and equipment are used per ANSI C63.5. The line impedance stabilization network (LISN) should be characterized at least once per year.

(4) The list of required equipment for each test method includes:

(i) 12/C01-Conducted Emissions: EMI meter, Spectrum Analyzer, CISPR Quasi-Peak Detector, Peak Detector;

(ii) 12/R01-Radiated Emissions: EMI Meter, Spectrum Analyzer, CISPR Quasi Peak Detector, Peak Detector;

(iii) 12/T01-Terminal Equipment Network Protection Standards: Surge Generator, True RMS Voltmeter, DC Voltmeter, DC Ammeter, Balance Test Set, Ringing Generator, AC Voltmeter, AC Power Supply or Leakage Current Test Set, DC Power Supply, Loop Simulator, Weighting Circuits, Analyzer, Oscillator (Amplifier), Filter, Vibration Table, Environmental Chamber; and

(iv) 12/T02-Terminal Equipment Network Protection Standards: Bandpass Filter, Feed Circuit, Helmholtz Coil, Level Recorder, Oscillator, Probe Coil, True RMS Voltmeter.

(5) Equipment may be leased or otherwise acquired for temporary use. This may occur due to equipment failure, extension of ranges, volume of work, etc.

When equipment that is not owned by the laboratory is used for testing, that equipment must meet all requirements of this program including the training of staff members in its use.

(g) Measurement traceability and calibration

(1) Measurement or quality control equipment, whether owned or leased by the laboratory, that is inherently subject to change due to use or to passage of time must be periodically calibrated. Calibrations of equipment may be performed by the laboratory or by an external calibration service. All calibrations and characterizations must be done with reference standards that are traceable to national standards maintained by the National Institute of Standards and Technology (formerly the National Bureau of Standards) or by an equivalent foreign national standards authority. A NVLAP-accredited calibration service laboratory fulfills the foregoing traceability requirement.

(2) The reference standards used, and the environmental conditions at the time of calibration, must be documented for all calibrations. Calibration records and evidence of the traceability of the reference standards used must be made available for inspection during the on-site visit.

(3) In addition to the information specified in NIST Handbook 150, Sec. 285.33(f)(4), test equipment or verification records should include the following:

(i) notation of all equipment variables requiring verification;

(ii) the range of verification;

(iii) the resolution of the instrument and its allowable error;

(iv) identity of the laboratory individual or external service responsible for calibration; and

(v) source of reference standard and traceability.

(4) The equipment used for conducting tests must be maintained and calibrated (or verified) in accordance with the manufacturer's recommendation or as specified in the test method, whichever is more appropriate.

(5) When automated test equipment or automated test systems are used, appropriate documentation, instructions for use and training are required. The laboratory must be able to verify that automated systems produce the same results as manual systems.

Laboratory procedures must ensure that manual control settings not read or controlled by the automated systems are correctly made and recorded. Procedures must be in place for monitoring the total performance of automated systems.

(6) Computer software used by the laboratory in the conduct of testing, including automated test equipment and systems, process control, computation, must be validated, documented and controlled. Computer software must be included in the laboratory inventory system. Procedures for software version control must be documented and followed.

Software, computers, and automated systems must be protected from unauthorized and/or inadvertent changes. When software in an automated system is changed by the equipment manufacturer or supplier, whether for maintenance, repair, or upgrade, the laboratory must verify that the changed software is correct before using it in testing.

A staff member should be assigned the responsibility of implementing, documenting and verifying changes to software and associated hardware. Documentation should include initial testing, error detection and resolution, updates, and upgrades.

Original and back-up software must be properly identified and stored. Old versions of software, if kept, must be stored to prevent accidental use.

(h) Calibration and test methods

(1) The test methods covered in this handbook are those required by the FCC in Part 15 using ANSI C63.4 and Part 68 using TIA/EIA TSB31-A.

(2) All test methods and procedures must be documented. Documentation must show in detail how the tests are conducted in this laboratory including; specific equipment, facilities, conditions, and personnel.

If unique test plans are used or when test plans are modified to meet special requirements of a client, these test plans should be available to laboratory personnel before testing begins. Special conditions must be indicated in test reports.

(3) In addition to the basic test method (i.e., FCC Parts 15 and 68), copies of documents which describe or extend the meaning of the basic documents (see Sec. 285.4 References) must be available to laboratory personnel when those documents apply to the testing being performed.

(4) If a laboratory calibrates its own antennas, explicit procedures and instructions for those calibrations must be maintained.

(i) Handling of calibration and test items

(1) Where confidentiality of equipment is required by the client, the laboratory policies and procedures shall be documented in the quality manual.

(2) The laboratory should have documented policies and procedures for the handling and tracking of items submitted for testing, including shipping and receiving, storage, system configuration, disposal, and if applicable, retention of tested items pending FCC registration and/or post-grant testing.

(j) Records

(1) A laboratory must maintain a functional record-keeping system. Records must be easily accessible and contain complete information on the subject. Records covering the following items are required and will be reviewed during

the on-site visit either in total or by selected sampling:

(i) staff training dates and results;

(ii) staff competency review dates and results;

(iii) testing equipment calibration and maintenance;

(iv) inspection of incoming materials;

(v) comprehensive logs of test activities;

(vi) results of internal and external equipment checks, measurement assurance programs, etc.;

(vii) test data and reports; and

(viii) tracking and logging of samples tested.

(2) The laboratory should maintain testing records in a test folder that contains the following information:

(i) raw test data;

(ii) plots, charts and graphs;

(iii) photographs;

(iv) diagrams;

(v) schematics;

(vi) test setup and test plan (everything necessary to meet the FCC requirements and to repeat tests); and

(vii) all other pertinent material not included in the client test report.

(k) Certificates and reports

There are two basic types of test reports:

- reports that are produced under contract and intended for use by the client; and

- reports to be submitted to the FCC for equipment authorization and registration purposes.

Reports intended for use only by the client shall meet NVLAP requirements, but need not necessarily meet all product certification requirements. Test reports created for submission to the FCC must meet the requirements of FCC Form 730 and FCC Form 731.

The test report or the test folder maintained by the laboratory must contain sufficient information for the exact test conditions to be repeated at a later time if a retest is necessary.

APPENDIX A

SAMPLE ACCREDITATION DOCUMENTS

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO/IEC GUIDE 58:1993
ISO 9002:1994

Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

LABORATORY, INC.
ANYTOWN, USA

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

~~January 1, 19--~~
Effective until

For the National Institute of Standards and Technology

NVLAP LAB CODE: 0000

National Institute of Standards and Technology

NVLAP®

National Voluntary Laboratory Accreditation Program

ISO/IEC GUIDE 25:1990
ISO/IEC GUIDE 58:1993
ISO 9002:1994

Scope of Accreditation

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 0000

LABORATORY, INC.
Anytown, USA 00000-0000
John Doe Phone: 000-000-0000

NVLAP Code	*Designation*
12/C01	Conducted Emissions, Power Lines, 450 KHz to 30 MHz FCC Method - 47 CFR Part 15 - Digital Devices
12/R01	Radiated Emissions FCC Method - 47 CFR Part 15 - Digital Devices
12/T01	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.302 Environmental simulation, Para. c, d, e, f 68.304 Leakage current limitations 68.306 Hazardous voltage limitations 68.308 Signal power limitations 68.310 Longitudinal balance limitations 68.312 On-hook impedance limitations 68.314 Billing protection
12/T02	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.316 Hearing aid compatibility: technical standards
12/T03	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.302 Environmental simulation, Para. a, b

January 1, 19--

Effective until

For the National Institute of Standards and Technology

APPENDIX B

GENERAL OPERATIONS CHECKLIST

GENERAL OPERATIONS CHECKLIST

Instructions to the Assessor: This checklist addresses general accreditation criteria prescribed in applicable sections of NIST Handbook 150, *NVLAP Procedures and General Requirements*.

This checklist follows and is numbered to correspond to the *NVLAP Procedures and General Requirements*, Subsection 285.33. The numbers in square brackets identify related checklist items. A small black triangle appears in the left-hand margin of selected lines of text throughout this checklist; the marked text applies only to the Calibration Laboratory Accreditation Program (LAP).

Place an "X" beside each checklist item which represents a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments in this list or on the attached comment sheets. Place a check beside all other items you observed or verified at the laboratory.

SEC. 285.33 CRITERIA FOR ACCREDITATION

(b) ***Organization and management***

(1) The laboratory shall be:

_____ (i) legally identifiable;

Legal name of laboratory ownership: _____

(ii) organized and shall operate in such a way that its permanent, temporary and mobile facilities meet the NVLAP requirements [see also (b)(2)(i), (c)(2)(ii)];

_____ (iii) properly identified on the NVLAP Application.

(2) The laboratory shall:

_____ (i) have managerial staff with the authority and resources needed to discharge their duties [see also (b)(1)(ii), (c)(2)(ii)];

_____ (ii) have policies to ensure that its personnel are free from any commercial, financial and other pressures which might adversely affect the quality of their work;

_____ (iii) be organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

_____ (iv) specify and document the responsibility, authority and interrelation of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

_____ (v) provide supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results. The ratio of supervisory to non-supervisory personnel shall be such as to ensure adequate supervision;

_____ (vi) have a technical manager (however named) who has overall responsibility for the technical operations;

Name of person: _____

_____ (vii) have a quality manager (however named) who has responsibility for the quality system and its implementation. The quality manager shall have direct access to the highest level of management at which decisions are taken on laboratory policy or resources, and to the technical manager. In some laboratories, the quality manager may also be the technical manager or deputy technical manager;

Name of person: _____

_____ (viii) nominate deputy(ies) in case of absence of the technical or quality manager;

Name(s): _____

_____ (ix) have documented policy and procedures to ensure the protection of clients' confidential information and proprietary rights [see also (c)(2)(xviii)];

_____ (x) where appropriate, participate in interlaboratory comparisons and proficiency testing programs [see also (c)(2)(xiv), (c)(6)(ii), (g)(3)];

_____ (xi) have documented policy and procedures to ensure that its clients are served with impartiality and integrity.

(c) ***Quality system, audit and review***

(1) The laboratory shall:

_____ (i) have an established and maintained quality system appropriate to the type, range and volume of calibration and testing activities it undertakes;

_____ (ii) have the elements of the quality system documented;

_____ (iii) ensure that the quality documentation is available for use by the laboratory personnel;

_____ (iv) define and document its policies and objectives for, and its commitment to, good laboratory practice and quality of calibration or testing services;

_____ (v) have the laboratory management which ensures that these policies and objectives are documented in a quality manual and communicated to, understood, and implemented by all laboratory personnel concerned;

_____ (vi) ensure that the quality manual is maintained current under the responsibility of the quality manager [see also (c)(2)(iv)].

Date of quality manual: _____

Date of latest update: _____

(2) The quality manual, and related quality documentation, shall state the laboratory's policies and operational procedures established in order to meet the NVLAP requirements. The quality manual and related quality documentation shall contain:

_____ (i) a quality policy statement, including objectives and commitments, by top management;

_____ (ii) the organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

_____ (iii) the relations between management, technical operations, support services and the quality system;

_____ (iv) procedures for control and maintenance of documentation [see also (c)(1)(vi), (j)(1)];

_____ (v) job descriptions of key staff and reference to the job descriptions of other staff;

_____ (vi) identification of the laboratory's approved signatories (list here or in the comments section): _____

_____

_____ (vii) the laboratory's procedures for achieving traceability of measurements;

_____ (viii) the laboratory's scope of calibrations and/or tests;

_____ (ix) written procedures for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

_____ (x) reference to the calibration, verification and/or test procedures used;

_____ (xi) procedures for handling calibration and test items;

_____ (xii) reference to the major equipment and reference measurement standards used;

_____ (xiii) reference to procedures for calibration, verification and maintenance of equipment;

_____ (xiv) reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes [see also (b)(2)(x), (c)(6)(ii), (g)(3)];

(xv) procedures to be followed for feedback and corrective action whenever:

_____ a) testing discrepancies are detected, or

_____ b) departures from documented policies and procedures occur;

_____ (xvi) the laboratory management policies for departures from documented policies and procedures or from standard specifications;

_____ (xvii) procedures for dealing with complaints [see also (n)];

_____ (xviii) procedures for protecting confidentiality and proprietary rights [see also (b)(2)(ix)];

_____ (xix) procedures for audit and review;

_____ (xx) a description of the laboratory's policy regarding the use of the NVLAP logo;

▸ _____ (xxi) a statement of the laboratory's policy for establishing and changing
▸ calibration intervals for equipment it controls; and

▸ _____ (xxii) a statement of the laboratory's policy concerning the technique(s) to be used
▸ for determining measurement uncertainty and calibration/verification
▸ adequacy.

_____ (3) The laboratory shall arrange for audits of its activities at appropriate intervals to verify that its operations continue to comply with the requirements of the quality system. Such audits shall be carried out by trained and qualified staff who are, wherever possible, independent of the activity to be audited. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibration or test results, the laboratory shall take immediate corrective action and shall immediately notify, in writing, any client whose work may have been affected.

The audits shall be objective and be conducted internally or on contract. The audits shall include both general criteria (documents, records and policies) and technical compliance (test methods and practices and calibration procedures).

_____ (4) The quality system adopted to satisfy the NVLAP requirements shall be reviewed at least once a year by the management to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements.

_____ (5) All audit and review findings and any corrective actions that arise from them shall be documented. The person responsible for quality shall ensure that these actions are discharged within the agreed timescale.

(6) In addition to periodic audits the laboratory shall ensure the quality of results provided to clients by implementing checks. These checks shall be reviewed and shall include, as appropriate, but not be limited to:

_____ (i) internal quality control plans, such as control charts and other available statistical techniques;

NOTE: Measurement assurance techniques are acceptable means to control the measurement process and consistently produce the highest quality measurements.

_____ (ii) participation in proficiency testing or other interlaboratory comparisons [see also (b)(2)(x), (c)(2)(xiv), (g)(3)];

_____ (iii) regular use of certified reference materials and/or in-house quality control using secondary reference materials;

_____ (iv) replicate testings using the same or different methods;

_____ (v) retesting of retained items;

_____ (vi) correlation of results for different characteristics of an item.

(d) ***Personnel*** [see also (c)(2)(v)]

_____ (1) The testing laboratory shall have sufficient personnel, having the necessary education, training, technical knowledge and experience for their assigned functions.

_____ (2) The testing laboratory shall ensure that the training of its personnel is kept up-to-date.

_____ (3) Records on the relevant qualifications, training, skills and experience of the technical personnel shall be maintained by the laboratory.

(e) ***Accommodation (facilities) and environment*** [see also (i)(3)]

_____ (1) Laboratory accommodation, calibration and test areas, energy sources, lighting, heating and ventilation shall be such as to facilitate proper performance of calibrations or tests.

NOTE: Laboratory design will be, to the maximum extent practical, in accordance with the guidelines found in the NCSL Recommended Practice #7, *Laboratory Design*, July 25, 1993.

_____ (2) The environment in which these activities are undertaken shall not invalidate the results or adversely affect the required accuracy of measurement. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

NOTE: It is expected that environments which do not meet generally accepted norms, such as those found in NCSL Recommended Practice #7, yet which exhibit the stability required to apply necessary correction factors, will be specified by the laboratory for the purpose of assessment of compliance with its own procedures to achieve its stated uncertainties.

_____ (3) The laboratory shall provide facilities for the effective monitoring, control and recording of environmental conditions as appropriate. Due attention shall be paid, for example, to biological sterility, dust, electromagnetic interference, humidity, voltage, temperature, and sound and vibration levels, as appropriate to the calibrations or tests concerned.

_____ (4) There shall be effective separation between neighboring areas when the activities therein are incompatible.

_____ (5) Access to and use of all areas affecting the quality of these activities shall be defined and controlled.

_____ (6) Adequate measures shall be taken to ensure good housekeeping in the laboratory.

NOTE: While it is the laboratory's responsibility to comply with relevant health and safety requirements, this is outside the scope of this assessment.

(f) ***Equipment and reference materials***

(1) The laboratory shall:

_____ (i) be furnished with all items of equipment (including hardware, software, and reference materials) required for the correct performance of calibrations and tests;

_____ (ii) in those cases where the laboratory needs to use equipment outside its permanent control, including rented, leased and client-owned equipment, ensure that the relevant NVLAP requirements are met.

_____ (2) All equipment shall be properly maintained. Maintenance procedures shall be documented. Any item of the equipment which has been subjected to overloading or mishandling, or which gives suspect results, or has been shown by verification or otherwise to be defective, shall be taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

_____ (3) Each item of equipment including reference materials shall, when appropriate, be labelled, marked or otherwise identified to indicate its calibration status.

_____ (4) Records shall be maintained of each item of equipment and all reference materials significant to the calibrations or tests performed. The records shall include:

_____ (i) the name of the item of equipment, software or reference material;

_____ (ii) the manufacturer's name, type identification, and serial number or other unique identification;

_____ (iii) date received and date placed in service;

NOTE: For initial accreditation, the date received and the date placed in service are not considered mandatory requirements for inclusion in laboratory records, although this is encouraged as good laboratory practice.

_____ (iv) current location, where appropriate;

_____ (v) condition when received (e.g., new, used, reconditioned);

_____ (vi) copy of the manufacturer's instructions, where available;

_____ (vii) dates and results of calibrations and/or verifications and date of next calibration and/or verification;

_____ (viii) details of maintenance carried out to date and planned for the future;

_____ (ix) history of any damage, malfunction, modification or repair;

▸ _____ (x) measured value observed for each parameter found to be out of tolerance
▸ during calibration/verification.

(g) ***Measurement traceability and calibration***

_____ (1) All measuring and testing equipment having an effect on the accuracy or validity of calibrations or tests shall be calibrated and/or verified before being put into service. The laboratory shall have an established program for the calibration and verification of its measuring and test equipment. The program will ensure the recall or removal from service of any standard or equipment which has exceeded its calibration interval or is otherwise judged to be unreliable.

_____ (2) The overall program of calibration and/or verification and validation of equipment shall be designed and operated so as to ensure that, wherever applicable, measurements made by the laboratory are traceable to national standards of measurement where available. Calibration certificates shall, wherever applicable, indicate the traceability to national standards of measurement and shall provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification.

NOTE: Traceability to national standards includes traceability to standards maintained or defined at national laboratories in foreign countries where applicable. In these cases, traceability is achieved via international standards. This includes intrinsic standards of measurement where available.

Where applicable, the methodology of the *Guide to the expression of uncertainty in measurement*: 1993, shall be used as the basis for expression of uncertainty of the measurement. NIST Technical Note 1297; January 1993, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, is a practical application document written around the *Guide to the expression of uncertainty in measurement*. Where detailed procedures are not used to quantify and combine uncertainties (i.e., use of test accuracy ratio concepts), the sources of uncertainty shall be tabulated and demonstrated to be acceptable for the measurement undertaken.

NOTE: A significant number of intrinsic standards, such as the Josephson Array Voltage Standard and the Iodine-Stabilized Helium-Neon Laser Length Standard, have been developed and are now being used by many national standards laboratories and some industrial laboratories. These standards are based on well-characterized laws of physics, fundamental constants of nature, or invariant properties of materials, and make ideal stable, precise, and accurate measurement standards if properly designed, characterized, operated, monitored and maintained. Where intrinsic standards are used, the laboratory should demonstrate by measurement assurance techniques, interlaboratory comparisons, or other suitable means, that its intrinsic standard measurement results are correlated with those of national or international standards.

_____ (3) Where traceability to national standards of measurement is not applicable, the laboratory shall provide satisfactory evidence of correlation of results, for example by participation in a suitable program of interlaboratory comparisons or proficiency testing [see also (b)(2)(x), (c)(2)(xiv), (c)(6)(ii)].

NOTE: Traceability requirements may also be satisfied by:

(i) internationally accepted standards in the field concerned;

(ii) suitable reference materials;

(iii) ratio or reciprocity measurements; or

(iv) mutual consent standards which are clearly specified and mutually agreed upon by all parties concerned.

_____ (4) Reference standards of measurement held by the laboratory shall be used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated.

_____ (5) Reference standards of measurement shall be calibrated by a body that can provide traceability to a national standard of measurement. There shall be a program of calibration and verification for reference standards.

_____ (6) Where relevant, reference standards and measuring and testing equipment shall be subjected to in-service checks between calibrations and verifications.

_____ (7) Reference materials shall, where possible, be traceable to national or international standards of measurement, or to national or international standard reference materials.

(h) ***Calibration and test methods***

_____ (1) The laboratory shall have documented instructions on the use and operation of all relevant equipment, on the handling and preparation of items and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests. All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be maintained up-to-date and be readily available to the staff.

_____ (2) The laboratory shall use appropriate methods and procedures for all calibrations and tests and related activities within its responsibility (including sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of calibration and/or test data). They shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

NOTES:

(i) Calibration procedures shall contain the required range and tolerance or uncertainty of each item or unit parameter being calibrated or verified. In addition, the procedures shall contain the generic description of the measurement standards and equipment needed with the required parameter, range, tolerances or uncertainties, and specifications for performing the measurement of the calibration or verification, and/or representative types (manufacturer, model, option) that are capable of meeting the generic description for the measurement standards. The procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations/verifications concerned.

(ii) The laboratory shall ensure that the calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected. Well-defined and documented measurement assurance techniques or uncertainty analyses may be used to verify the adequacy of a measurement process. If such techniques are not used, then the collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance (e.g., manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated or verified.

_____ (3) Where methods are not specified, the laboratory shall, wherever possible, select methods that have been published in international or national standards, those published by reputable technical organizations or in relevant scientific texts or journals.

_____ (4) Where it is necessary to employ methods that have not been established as standard, these shall be subject to agreement with the client, be fully documented and validated, and be available to the client and other recipients of the relevant reports [see also (k)(2)(x)].

_____ (5) Where sampling is carried out as part of the test method, the laboratory shall use documented procedures and appropriate statistical techniques to select samples [see also (k)(2)(ix)].

_____ (6) Calculations and data transfers shall be subject to appropriate checks.

(7) Where computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of calibration or test data, the laboratory shall have written procedures which ensure that:

_____ (i) the NVLAP requirements are complied with;

_____ (ii) computer software, computers or automated equipment is documented and adequate for use;

_____ (iii) procedures are established and implemented for protecting the integrity of data; such procedures shall include, but not be limited to, integrity of data entry or capture, data storage, data transmission and data processing;

_____ (iv) computer and automated equipment is maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data [see also (f)(1)];

_____ (v) it establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

_____ (8) Documented procedures shall exist for the purchase, reception and storage of consumable materials used for the technical operations of the laboratory [see also (m)(2)].

(i) ***Handling of calibration and test items***

_____ (1) The laboratory shall have a documented system for uniquely identifying the items to be calibrated or tested, to ensure that there can be no confusion regarding the identity of such items at any time [see also (k)(2)(v)].

_____ (2) Upon receipt, the condition of the calibration or test item, including any abnormalities or departures from standard condition as prescribed in the relevant calibration or test method, shall be recorded. Where there is any doubt as to the item's suitability for calibration or test, where the item does not conform to the description provided, or where the calibration or test required is not fully specified, the laboratory shall consult the client for further instruction before proceeding. The laboratory shall establish whether the item has received all necessary preparation, or whether the client requires preparation to be undertaken or arranged by the laboratory.

_____ (3) The laboratory shall have documented procedures and appropriate facilities to avoid deterioration or damage to the calibration or test item, during storage, handling, preparation, and calibration or test; any relevant instructions provided with the item shall be followed. Where items have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored and recorded where necessary. Where a calibration or test item or portion of an item is to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory shall have storage and security arrangements that protect the condition and integrity of the secured items or portions concerned [see also (e)].

_____ (4) The laboratory shall have documented procedures for the receipt, retention or safe disposal of calibration or test items, including all provisions necessary to protect the integrity of the laboratory.

_____ (5) Tamper-resistant seals shall be affixed to operator-accessible controls or adjustments on measurement standards or measuring and test equipment which, if moved, will invalidate the calibration. The laboratory's calibration system shall provide instructions for the use of such seals and for the disposition of equipment with damaged or broken seals.

NOTE: Tamper-resistant seals are sometimes affixed to equipment to prevent unauthorized access to areas where adjustments or critical components are located.

(j) *Records*

_____ (1) The laboratory shall maintain a record system to suit its particular circumstances and comply with any applicable regulations. It shall retain on record all original observations, calculations and derived data, calibration records and a copy of the calibration certificate, test certificate or test report for an appropriate period. The records for each calibration and test shall contain sufficient information to permit their repetition. The records shall include the identity of personnel involved in sampling, preparation, calibration or testing [see also (c)(2)(iv)].

▸ **EXCEPTION:** The retention of all original observations, calculations, and
▸ derived data in the calibration record system is not a mandatory requirement
▸ for calibration laboratories, although it is encouraged as good laboratory
▸ practice.

_____ (2) All records (including those listed in (f)(4) pertaining to calibration and test equipment), certificates and reports shall be safely stored, held secure and in confidence to the client [see also (b)(2)(ix), (c)(2)(xviii)].

NOTE: The period of retention shall be specified in the quality manual.

Record retention time specified: _____

(k) ***Certificates and reports***

_____ (1) The results of each calibration, test, or series of calibrations or tests carried out by the laboratory shall be reported accurately, clearly, unambiguously and objectively, in accordance with any instructions in the calibration or test methods. The results should normally be reported in a calibration certificate, test report or test certificate and should include all the information necessary for the interpretation of the calibration or test results and all information required by the method used [see also (k)(4)(i)].

NOTE: It is recognized that the results of each calibration do not always result in the production of a calibration certificate or report. Whenever a certificate or report is produced, the above requirements shall be met.

(2) Each certificate or report shall include at least the following information:

_____ (i) a title, e.g., "Calibration Certificate," "Test Report" or "Test Certificate";

_____ (ii) name and address of laboratory, and location where the calibration or test was carried out if different from the address of the laboratory;

_____ (iii) unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

_____ (iv) name and address of client, where appropriate;

_____ (v) description and unambiguous identification of the item calibrated or tested [see also (i)(1)];

_____ (vi) characterization and condition of the calibration or test item;

_____ (vii) date of receipt of calibration or test item and date(s) of performance of calibration or test, where appropriate;

EXCEPTION: Although it is encouraged as good laboratory practice, the requirement for inclusion of the date received is not mandatory for calibration laboratories.

_____ (viii) identification of the calibration or test method used, or unambiguous description of any non-standard method used;

_____ (ix) reference to sampling procedure, where relevant [see also (h)(5)];

_____ (x) any deviations from, additions to or exclusions from the calibration or test method, and any other information relevant to a specific calibration or test, such as environmental conditions [see also (c)(2)(xv), (h)(4)];

_____ (xi) measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified;

_____ (xii) a statement of the estimated uncertainty of the calibration or test result, where relevant;

_____ (xiii) a signature and title, or an equivalent identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue [see also (c)(2)(vi)];

_____ (xiv) where relevant, a statement to the effect that the results relate only to the items calibrated or tested;

_____ (xv) a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

_____ (xvi) a statement that the report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government;

_____ (xvii) the signature of an approved signatory for all test and calibration reports endorsed with the NVLAP logo;

► _____ (xviii) special limitations of use; and

► _____ (xix) traceability statement.

_____ (3) Where the certificate or report contains results of calibrations or tests performed by subcontractors, these results shall be clearly identified [see also (l)].

_____ (4) Particular care and attention shall be paid to the arrangement of the certificate or report, especially with regard to presentation of the calibration or test data and ease of assimilation by the reader. The format shall be carefully and specifically designed for each type of calibration or test carried out, but the headings shall be standardized as far as possible [see also (k)(1)].

_____ (5) Material amendments to a calibration certificate, test report or test certificate after issue shall be made only in the form of a further document, or data transfer including the statement "Supplement to Calibration Certificate (or Test Report or Test Certificate), serial number ... (or as otherwise identified)," or equivalent form of wording. Such amendments shall meet all the relevant requirements of item (j).

_____ (6) The laboratory shall notify clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report, or test certificate or amendment to a report or certificate.

NOTE: Such notification shall quantify the magnitude of error created in the calibration results. The laboratory shall notify customers promptly, in writing, of any customer's measuring and test equipment found significantly out of tolerance during the calibration/verification process. Measurement data shall be reported so that appropriate action can be taken.

_____ (7) The laboratory shall ensure that, where clients require transmission of calibration or test results by telephone, telex, facsimile or other electronic or electromagnetic means, staff will follow documented procedures that ensure that the NVLAP requirements are met and that confidentiality is preserved.

_____ (8) Whenever a laboratory accredited by NVLAP issues a calibration or test report which contains data covered by the accreditation and also data not covered by the accreditation, it must clearly identify in its records, and in the report to the client, specifically which calibration or test method(s), or portion of a calibration or test method(s), was not covered by the accreditation. The laboratory must also inform the client, before the fact, when calibrations or tests requested are not covered by the accreditation.

NVLAP policy regarding calibration and test reports issued by an accredited laboratory, which reference the laboratory's accredited status, requires that any calibration or test report containing data from calibrations or tests which are not covered by the accreditation include:

_____ (i) a statement at the beginning of the report prominently indicating, "This report contains data which are not covered by the NVLAP accreditation"; and

_____ (ii) a clear indication of which data are not covered by the accreditation.

The laboratory must not misrepresent its accreditation. When a client requires or requests accredited services and any of the requested services are not covered by the accreditation, the client must be so advised.

(l) ***Subcontracting of calibration or testing*** [see also (k)(3)]

_____ (1) Where a laboratory subcontracts any part of the calibration or testing, this work shall be placed with a laboratory complying with these requirements. The laboratory shall ensure and be able to demonstrate that its subcontractor is competent to perform the activities in question and complies with the same criteria of competence as the laboratory in respect of the work being subcontracted. The laboratory shall advise the client in writing of its intention to subcontract any portion of the testing to another party.

_____ (2) The laboratory shall record and retain details of its investigation of the competence and compliance of its subcontractors and maintain a register of all subcontracting.

_____ (3) A NVLAP-accredited laboratory intending to subcontract testing or calibration work that will be performed and reported as meeting NVLAP procedures and criteria must:

_____ (i) have in its quality manual a subcontracting policy compatible with the NVLAP policy, with a description of the procedures for administering and implementing those actions to demonstrate the conformance and consistency of the subcontracted laboratory to perform according to NVLAP procedures;

_____ (ii) place the subcontracted work with a laboratory that maintains accreditation established by NVLAP shown by a current NVLAP Lab Code, or provide and maintain current records that demonstrate that the subcontracted laboratory is competent to perform the test(s) or calibration(s) and that it operates in a manner consistent with and in conformance to NVLAP criteria for accreditation;

_____ (iii) clearly identify in its records, and in the report to the client, exactly which data were obtained by the NVLAP-accredited laboratory and which data were obtained by the subcontractor, NVLAP-accredited or not;

_____ (iv) inform its client, before the fact, that it intends to subcontract for completion of all or a portion of the client's work; and

_____ (v) include at the beginning of the report the name, address, and contact person of the subcontracted laboratory(ies), and one of the following statements, as appropriate:

if NVLAP-accredited

"This report contains data which were produced by a subcontracted laboratory **ACCREDITED (NVLAP LAB CODE)** for the calibration or test methods performed"

if not NVLAP-accredited

"This report contains data which were produced by a subcontracted laboratory **NOT ACCREDITED** for the calibration or test methods performed."

The requirements of this section do not supersede any regulation, law, contract specification, or other related conditions which require NVLAP accreditation.

(m) ***Outside support services and supplies***

_____ (1) Where the laboratory procures outside services and supplies in support of calibrations or tests, the laboratory shall use only those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's calibrations or tests.

_____ (2) Where no independent assurance of the quality of outside support services or supplies is available, the laboratory shall have procedures to ensure that purchased equipment, materials and services comply with specified requirements. The laboratory should, wherever possible, ensure that purchased equipment and consumable materials are not used until they have been inspected, calibrated or otherwise verified as complying with any standard specifications relevant to the calibrations or tests concerned [see also (h)(8)].

_____ (3) The laboratory shall maintain records of all suppliers from whom it obtains support services or supplies required for calibrations or tests.

(n) ***Complaints*** [see also (c)(2)(xvii)]

_____ (1) The laboratory shall have documented policy and procedures for the resolution of complaints received from clients or other parties about the laboratory's activities. A record shall be maintained of all complaints and of the actions taken by the laboratory.

_____ (2) Where a complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the NVLAP requirements or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with item (c)(3).

(o) ***Measuring and test equipment (M & TE)***

NOTE: This section applies to the control of measuring and test equipment (M & TE) used to assure that supplies and services comply with prescribed customer requirements. It is based in large part on the requirements found in government audit standards such as MIL-STD 45662A, and is found in Part II of the ANSI/NCSL Z540-1-1994 (Draft) standard.

(1) General requirements for M & TE

_____ (i) The supplier shall establish and document a system to control the calibration/verification of M & TE.

_____ (ii) M & TE used to determine compliance with customer technical specifications shall be calibrated or verified in accordance with sections 285.33(b) through (n).

_____ (iii) The supplier shall have a program to recall for calibration or verification, or remove from service, M & TE that has exceeded its calibration interval, has broken calibration seals, or is suspected to be malfunctioning because of mishandling, misuse, or unusual results.

_____ (iv) All operations performed by the supplier in compliance with these requirements shall be subject to customer verification at unscheduled intervals.

_____ (v) The supplier shall carry out, or arrange to have carried out, periodic quality auditing of the calibration and verification system in order to ensure its continuing effective implementation and compliance with these requirements.

- Based on the results of the audits and any other relevant factors, such as customer feedback, the supplier shall review and modify the system as necessary.

- Plans and procedures for the audits shall be documented. The conduct of the audit and any subsequent corrective action shall also be documented.

(2) Detailed requirements for M & TE

_____ (i) Calibration system description: The supplier shall provide and maintain a written description of the calibration/verification system covering M & TE and measurement standards. The description shall be sufficient to satisfy each requirement of section 285.33(o) and any deviations shall be submitted with supporting documentation to the customer for approval.

_____ (ii) Adequacy of measurement standards: Measurement standards used by the supplier for calibrating M & TE and other measurement standards shall comply with the requirements of items (f)(1), (g)(1), and (h)(2).

_____ (iii) Environmental conditions: M & TE shall be used in an environment controlled to the extent necessary to ensure valid results. Due consideration shall be given to temperature, humidity, lighting, vibration, dust control, cleanliness, electromagnetic interference and any other factors affecting the results of measurements. Where pertinent, these factors shall be monitored and recorded and, when appropriate, correcting compensations shall be applied to measurement results.

_____ (iv) Intervals of calibration and verification: M & TE requiring calibration shall be calibrated or verified at periodic intervals established and maintained to assure acceptable reliability, where reliability is defined as the probability that M & TE will remain in-tolerance throughout the interval. Intervals shall be established for all M & TE requiring calibration unless the equipment is regularly monitored through the use of check standards in a documented measurement assurance process. Check standards must closely represent the item parameters normally tested in the process and the check standard must be verified periodically. Where intervals are used to ensure reliability, the interval setting system must be systematically applied and shall have stated reliability goals and a method of verifying that the goals are being attained. Intervals may be based on usage or time since last calibration or verification. All exemptions from periodic calibration or verification shall be documented. The recall system may provide for the temporary extension of the calibration due date for limited periods of time under specified conditions that do not unreasonably impair the satisfaction of the customer's requirements.

_____ (v) Calibration procedures: Procedures used to calibrate/verify the supplier's M & TE shall comply with the requirements of items (h)(1) and (h)(2).

_____ (vi) Out-of-tolerance conditions: If any M & TE is found to be significantly out of tolerance during the calibration/verification process, the supplier's system shall provide for notification to the user and to the supplier's quality element, if appropriate, of the out-of-tolerance condition with the associated measurement data so that appropriate action can be taken.

_____ (vii) Adequacy of calibration system: The supplier shall establish and maintain documented procedures to evaluate the adequacy of the calibration system and to ensure compliance with these requirements.

_____ (viii) Calibration sources: M & TE requiring calibration shall be calibrated or verified by laboratories that comply with sections 285.33(b) through (n).

_____ (ix) Records: These requirements shall be supported by records documenting that established schedules and procedures are followed to maintain the adequacy of all M & TE. The records for M & TE requiring calibration shall include an individual record of calibration or verification, or other means of control, providing a description or identification of the item, calibration interval, date calibrated, identification of the calibration source, calibration results (data and/or condition status) and calibration action taken (adjusted, repaired, new value assigned, derated, etc.).

_____ (x) Calibration status: M & TE shall be labeled to indicate calibration or verification status. The label shall identify specific date calibrated (day, month, year, Julian date, or equivalent) and the specific calibration due date or usage equivalent. Items not calibrated to their full capability or which have other limitations of use, shall be labeled or otherwise identified as to the limitations. When it is impractical to apply a label directly to an item, the label may be affixed to the instrument container or some other suitable means may be used to reflect calibration status. Tamper-resistant seals are affixed to operator accessible controls or adjustments which if moved will invalidate the calibration. The quality system shall provide instructions for the disposition of equipment with broken tamper-resistant seals.

_____ (xi) Control of subcontractor calibration: The supplier is responsible for assuring that the subcontractor's calibration system conforms to section 285.33 (l) to the degree necessary to assure compliance with contractual requirements. NVLAP accreditation of the subcontractor's laboratory can serve as the basis for compliance with this requirement.

_____ (xii) Storage and handling: M & TE shall be handled, stored, and transported in a manner which shall not adversely affect the calibration or condition of the equipment.

NVLAP LAB CODE: [ ]

GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

APPENDIX C

SPECIFIC OPERATIONS CHECKLIST - FCC PART 15-DIGITAL DEVICES

NVLAP LAB CODE: _____

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FCC PART 15-DIGITAL DEVICES

This checklist is designed for use by a NVLAP Technical Expert(s) (TE) during the conduct of an on-site assessment for initial or renewal of accreditation. The checklist contains items from the NVLAP Program Handbook(s), 15 CFR Part 285-NVLAP Procedures and General Requirements, 47 CFR-Telecommunications-Part 15, ANSI C63.4, CISPR 22 and other technical references. This checklist will be used in conjunction with other NVLAP checklists.

The completed checklist becomes a part of the laboratory ON-SITE ASSESSMENT REPORT which is used in the evaluation of the laboratory for granting or renewal of accreditation. Deficiencies noted in this checklist must be resolved in accordance with the NVLAP Procedures. Comments not specified as deficiencies may be directed to the laboratory by the TE.

Laboratory Name _____

NVLAP Technical Expert(s) _____

On-Site Dates _____

Facility and Test Site(s) Assessed _____

Instructions to Laboratory

Respond in writing within 30 days of the date of this report, addressing all deficiencies documented by the assessor. Each deficiency must be referenced, in your response, by number as it is listed in the report.

This on-site assessment report conveys the opinion of the assessor as a single representative of NVLAP. The final evaluation of your laboratory for the purpose of recommending approval or denial of accreditation will be conducted by NIST evaluators who will review this report, the written information submitted by you, and results of any required proficiency testing. You must respond to this report by identifying the actions you have taken, or plan to take, to correct the deficiencies identified. Respond in detail so that an accurate evaluation can be completed. Failure to respond may delay an accreditation decision. Questions concerning this report should be directed to NVLAP.

The assessor has discussed the contents of this report with members of the laboratory management who agree to respond in writing to NIST, regarding resolution or correction of any deficiencies noted, within 30 days of the date of this report.

Signature of Authorized Representative or designee	Printed Name	Date

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FCC PART 15-DIGITAL DEVICES

Summary of the NVLAP requirements for FCC Part 15 testing:

_____ The laboratory must meet all NVLAP general criteria as stated in NIST Handbook 150.

_____ The laboratory must meet all NVLAP technical criteria as stated in the program specific handbook.

_____ Laboratories shall keep at their facility appropriate, up-to-date files as part of their documentation system. The files must be covered by the laboratory quality system.

_____ The files shall be available for review by the NVLAP on-site assessor(s) during regular on-site or monitoring visits.

_____ Each radiated and line conducted emissions test site (including open area, anechoic chambers, and weather protected sites) that is used for FCC equipment authorization testing shall meet the FCC Facility Listing requirements.

_____ Testing for FCC registration must be conducted using ANSI C63.4 or other FCC approved standard.

_____ Antennas must be calibrated per ANSI C63.4 section 4.4.1 and ANSI C63.5. "Traceability is the property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM 1993)

COPYRIGHT STATEMENT

Figures 1, 5, 9(a)-9(d), and 11 are reprinted from ANSI Std. C63.4-1992, American National Standard for Standard Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz, copyright ©1992 by the Institute of Electrical and Electronics Engineers, Inc. The IEEE takes no responsibility for and will assume no liability for damages resulting from the reader's misinterpretation of said information resulting from the placement and context in this publication. Information is reproduced with the permission of the IEEE.

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FCC PART 15-DIGITAL DEVICES

Instructions to the Assessor: This checklist addresses specific criteria relating to FCC facility listing requirements.

Place an "X" beside any of the following items which represent a NVLAP deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments in this list or on the comment sheet(s).

Place a check beside all other items you observed or verified at the laboratory. All items must be marked.

I. MEASUREMENT INSTRUMENTATION

A. Line Impedance Stabilization Network (LISN).

_____ 1. Is a 50 ohm, 50 microhenry LISN used?

_____ A 5 microhenry LISN is NOT allowed to be used.

_____ 2. Does LISN have a calibration sticker on it?

_____ 3. Has LISN impedance and insertion loss been calibrated within the last year?

_____ 4. Is the Impedance of the LISN measured at the AC receptacle socket with 50 ohm termination on the instrumentation monitoring port? The tolerance is +30% and -20% of nominal Impedance shown in Figure 1.

_____ 5. Is the insertion loss greater than 0.5 dB?

_____ 6. Is a correction factor used when measuring conducted emissions? If so, then why? Is it because the LISN insertion loss is greater than 0.5 dB?

B. Antennas in frequency range from 30 MHz to 40 GHz.

_____ 1. Are all the antennas used for final compliance testing calibrated?

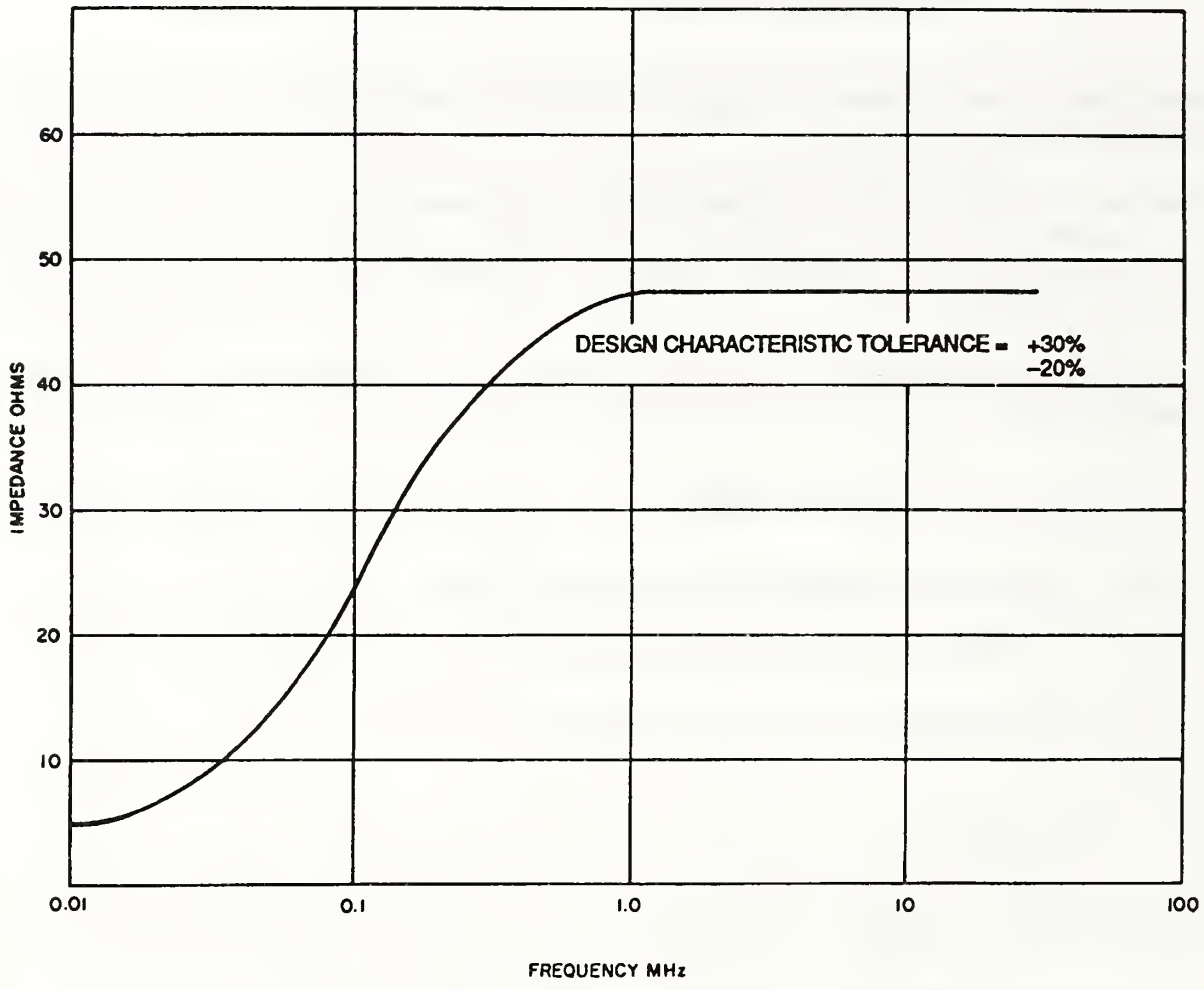


Figure 1. Impedance Characteristic of LISN at EUT Port
10 kHz to 30 MHz.

_____ 2. Are these antennas linearly polarized?

_____ 3. Are tuned dipoles used in the frequency range from 30 to 1000 MHz?

_____ 4. Are broadband antennas used for final compliance measurements?

_____ 5. Are standard gain horns used in the frequency range from 1 to 40 GHz?

_____ 6. Are antennas calibrated at least once a year?

_____ 7. Do all antennas used for final compliance have calibration stickers on them?

C. Measurement Receiver or Spectrum Analyzer.

_____ 1. Is the measuring receiver or spectrum analyzer calibrated?

_____ 2. Has unit been calibrated within the last Year?

_____ 3. Is peak detector function available?

_____ 4. Is average detector function available?

_____ 5. Is quasi-peak detector function available?

_____ 6. Is any video filtering or post detector filtering used? If so, then bandwidth must be wide enough so an not to affect the peak detector readings.

_____ 7. Is the minimum bandwidth for frequency range from 9 kHz to 150 kHz; 100 Hz?

_____ 8. Is the minimum bandwidth for frequency range from 150 kHz to 30 MHz; 9 kHz?

_____ 9. Is the minimum bandwidth for frequency range from 30 MHz to 1000 MHz ; 100 kHz?

_____ 10. Is the minimum bandwidth for frequency range from 1 GHz to 40 GHz; 1 MHz?

_____ 11. Does the measuring instrumentation using any of the three detector functions have a linear response?

II. TEST FACILITIES

A. Test Setup & Facilities for Measuring Conducted Emissions.

_____ 1. Is the powerline conducted ambient at least 6 dB below the limit?

_____ 2. Are powerline filters used between the LISN and the incoming power source?

_____ 3. Are conducted emission measurements being made in a shielded enclosure?

_____ 4. Are conducted emission measurements monitored by a loudspeaker or headphones?

_____ 5. Are conducted emission measurements observed by a video display using a time-based oscilloscope?

_____ 6. Is the ground plane for measuring conducted emissions a minimum of 2 X 2 m in size?

_____ 7. Is the ground plane part of a shielded chamber?

_____ 8. For a floor standing EUT, does the horizontal ground plane extend 0.5 m beyond the vertical projection (footprint) of the EUT?

_____ 9. Is the horizontal ground plane covered with an insulating material of 3 to 12 mm in thickness?

_____ 10. For a table top EUT, does the vertical ground plane have a minimum size of 2 X 2 m and located 40 cm to the rear of the EUT?

_____ 11. Is the horizontal and vertical ground planes connected at intervals not greater than 1 m along its entire length through low impedance connections of not less than 3 cm wide metal straps?

For measuring conducted emissions on an open area test site for table top EUT and floor standing EUT please refer to Section 5.2.2 for acceptable criteria.

_____ 12. Is the LISN grounded to the ground plane?

_____ 13. How is the LISN grounded to the ground plane? ____metal straps? ____braid straps? _____other?

_____ 14. Is the test platform for a table top EUT 1 X 1.5 m in size and raised 80 cm above the ground plane?

_____ 15. Are the I/O connecting cables always at least 40 cm above the ground plane?

_____ 16. If a monitor can be powered through an outlet on the host unit, then is conducted emission testing performed with the monitor powered through the host and with the monitor powered separately?

_____ 17. Are AC power cords that are used for conducted emission testing of the same electrical and shielding characteristics that are shipped with the EUT?

_____ 18. Are all surfaces of floor standing and table top EUTs at least 80 cm from any other grounded surface, including all LISNs? (The exception is the 40 cm distance from the rear of the EUT to the vertical ground plane).

_____ 19. Are adapters between the EUT power cord plug and the LISN power socket less than 20 cm long and contain only 1 plug and 1 receptacle?

_____ 20. Is the LISN safely grounded?

_____ 21. Is the excess power cord length between the EUT and the LISN folded back and forth in a bundle, located in the center of the power cord, not to exceed 40 cm?

_____ If non-flexible power leads are used, please refer to Section 7.2.1 for acceptable criteria.

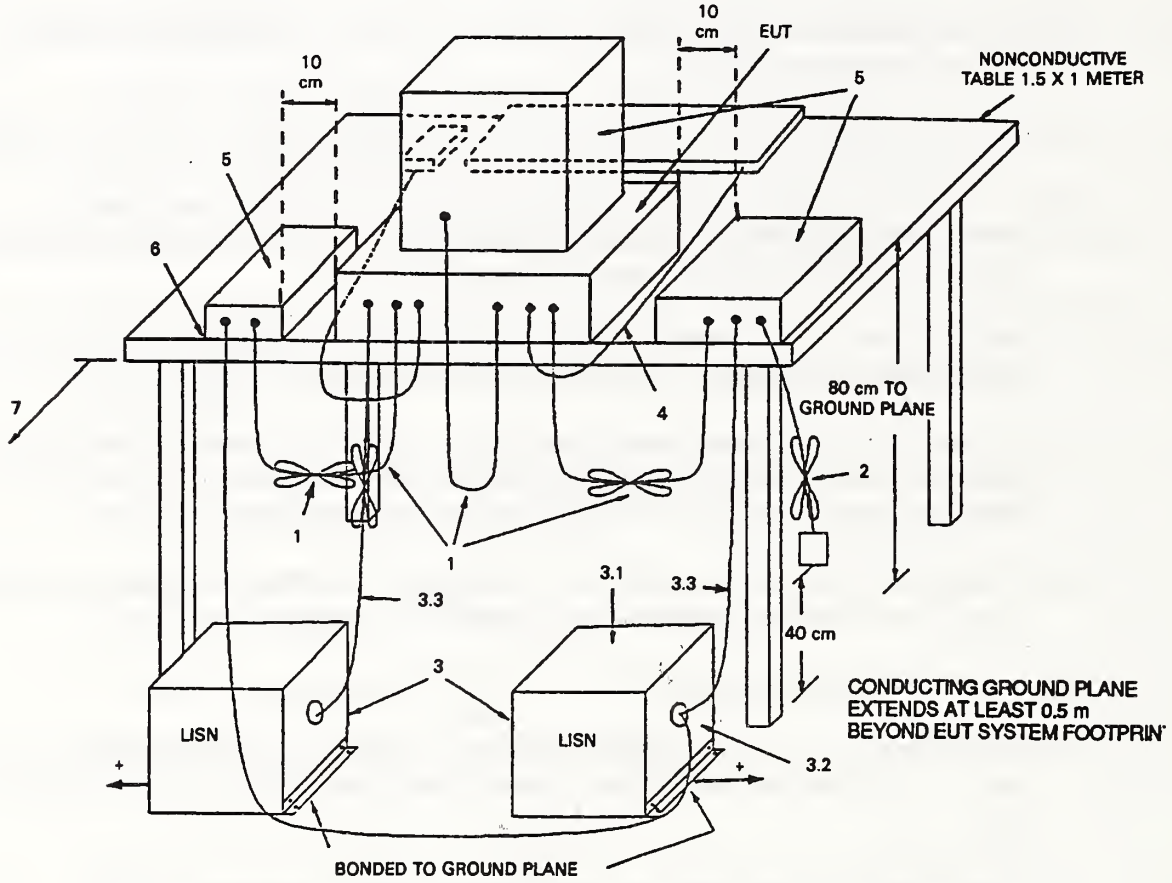
_____ 22. Is the conducted emission test setup in accordance with Figure 9(a) for a table top EUT and Figure 9(b) for a floor standing EUT?

_____ 23. Is the measurement frequency range used for measuring conducted emissions 450 kHz to 30 MHz?

_____ 24. Are all measuring ports of the LISN terminated in 50 ohms?

_____ 25. Is the EUT connected to one LISN and all the peripherals connected to a second LISN?

_____ 26. Based on preliminary tests, does this conducted emission compliance test represent the maximized cable configuration and worse case mode of EUT operation yielding the highest levels?

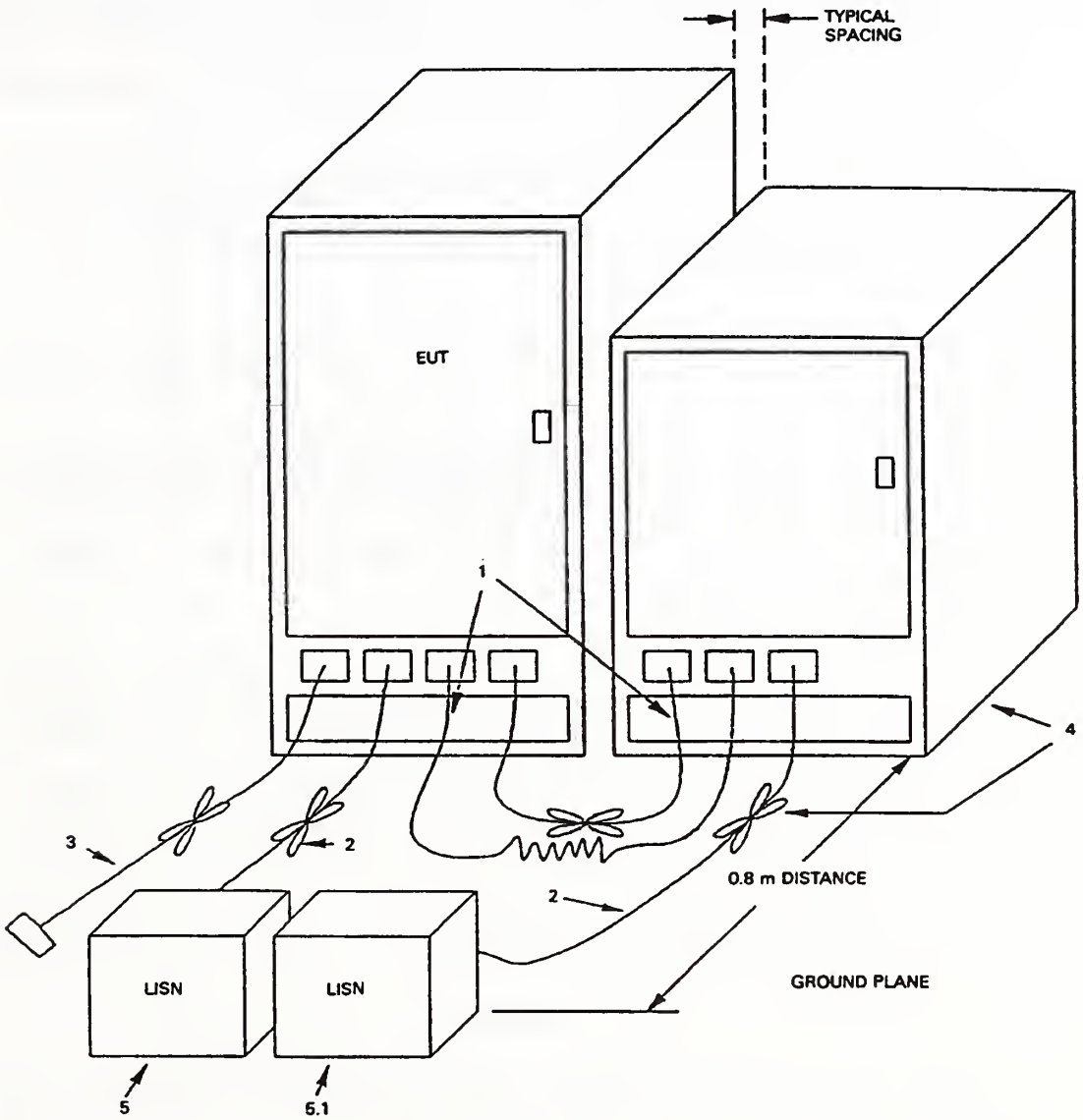


†LISNs may have to be moved to the side to meet 3.3 below.

LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, ground plane.
   - 3.1 All other equipment powered from second LISN.
   - 3.2 Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
   - 3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the host.
5. Non-EUT components being tested.
6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane (see 5.2).

Figure 9(a). Test Configuration
Tabletop Equipment Conducted Emissions.



LEGEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling shall not exceed 40 cm in length.
2. Excess power cords shall be bundled in the center or shortened to appropriate length.
3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.
4. EUT and all cables shall be insulated from ground plane by 3 to 12 mm of insulating material.
5. EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, ground plane.
   5.1 All other equipment powered from second LISN.

Figure 9(b). Test Configuration
Floor-Standing Equipment Conducted Emissions.

B. Test Setup & Facilities for Measuring Radiated Emissions.

_____ 1. Is ambient level at least 6 dB below the specified limits for radiated emissions?

_____ 2. Are measurement readings taken a minimum of 16 azimuth angles spaced nominally at 22.5 degrees?

_____ 3. Is a turntable used for rotating the EUT through the 360 degree azimuth?

_____ 4. For floor standing EUT use; is the turntable flush mounted, metal covered and flush with the ground plane?

_____ 5. Is a LISN used in the radiated emission test setup for measuring conducted emissions?

_____ 6. If yes, then is the receptacle for the EUT power connection to the LISN bonded to the open area test site ground plane and located flush with the ground plane?

_____ 7. Has it been verified that the LISN does not cause inaccuracy in radiated emission measurements?

_____ 8. Are the LISNs located below the turntable?

_____ 9. Are measurements made at 3 m distance between EUT and antenna?

_____ 10. Are measurements made at 10 m distance between EUT and antenna?

_____ 11. Are measurements made at 30 m distance between EUT and antenna?

_____ 12. Is the location of the instrument facility outside the ellipse (obstruction-free area) defined in Figure 5?

_____ 13. Is the terrain within the obstruction-free area smooth and flat?

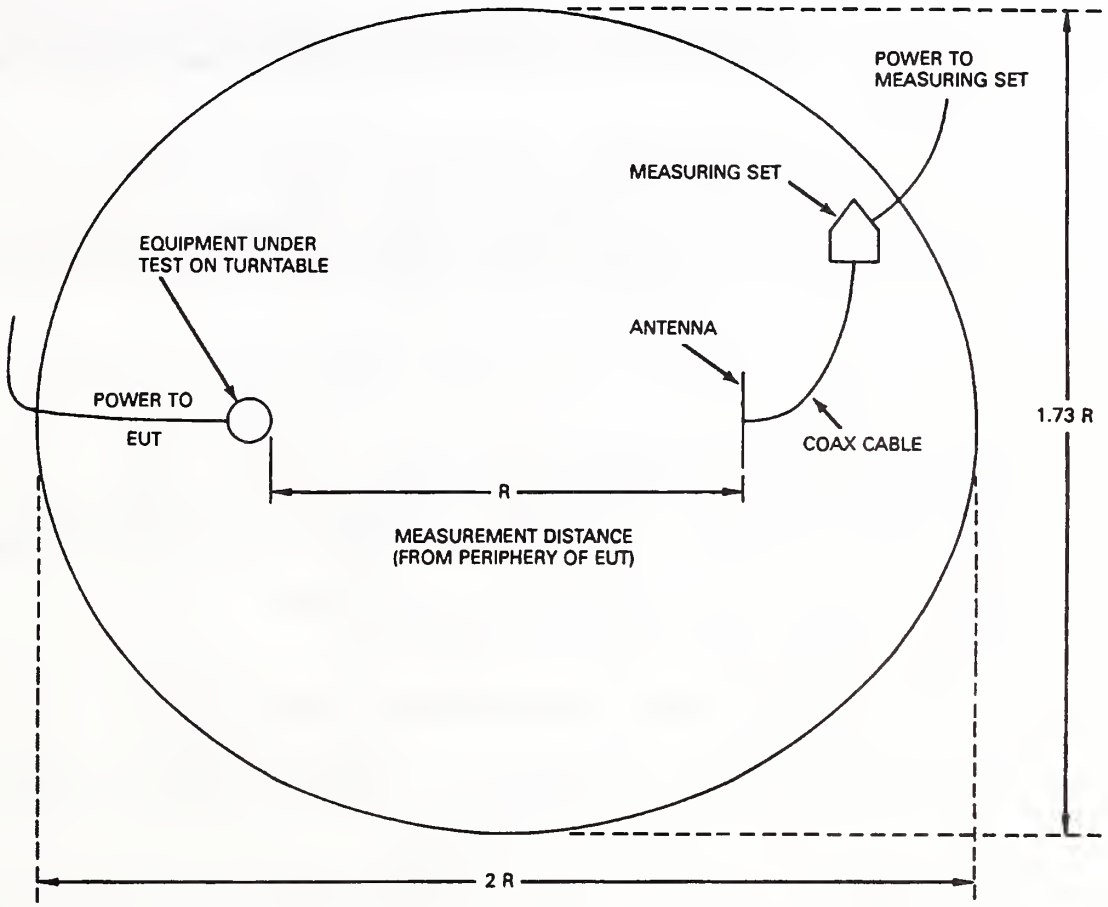
_____ 14. Does the ground plane have gaps with linear dimensions less than 1/10 of a wavelength?

_____ 15. Is the ground plane connected to the surrounding earth?

_____ 16. If so, is the connection continuous and with ground rods?

_____ 17. Has ANSI C63.7-1992 "Guide for Construction of Open Area Test Sites for Performing Radiated Emission Measurements" been followed in building this radiated test site?

_____ 18. Has CISPR 16-1 1993, Annex L been followed in building this radiated test site?



AREA DIMENSIONS =	R = 3 m	10 m
	6 m X 5.2 m	20 m X 17.3 m

Figure 5. Radiated Emissions Measurement Obstruction-Free Area for Site with a Turntable.

_____ 19. Is the distance between the EUT and antenna measured from the closest periphery of the EUT to the center of the axis of the elements of the receiving antenna?

_____ 20. At any measurement distance is the antenna height varied from 1 to 4 m?

_____ 21. If a monitor can be powered through an outlet on the host unit, then is conducted emission testing performed with the monitor powered through the host and with the monitor powered separately?

_____ 22. Is the antenna height being scanned in both the horizontal and vertical polarization?

_____ 23. Is an antenna positioner used?

_____ 24. Is the antenna positioner made of mostly nonconductive and nonreflecting materials?

_____ 25. Are there index marks on the antenna mast?

_____ 26. Is most everything on top of the ground plane nonconductive?

_____ 27. Are there index marks on the turntable or an electronic readout of position of the turntable?

_____ 28. Is the antenna clearance to the ground plane always a minimum of 25 cm?

_____ 29. Are the I/O connecting cables always at least 40 cm above the ground plane?

_____ 30. Is caution exercised by the tester to insure that small radiated emission lobes are properly detected in the 1 to 40 GHz frequency range?

_____ 31. Is the radiated emission test setup in accordance with Figure 9(c) for a table top EUT and Figure 9(d) for a floor standing EUT?

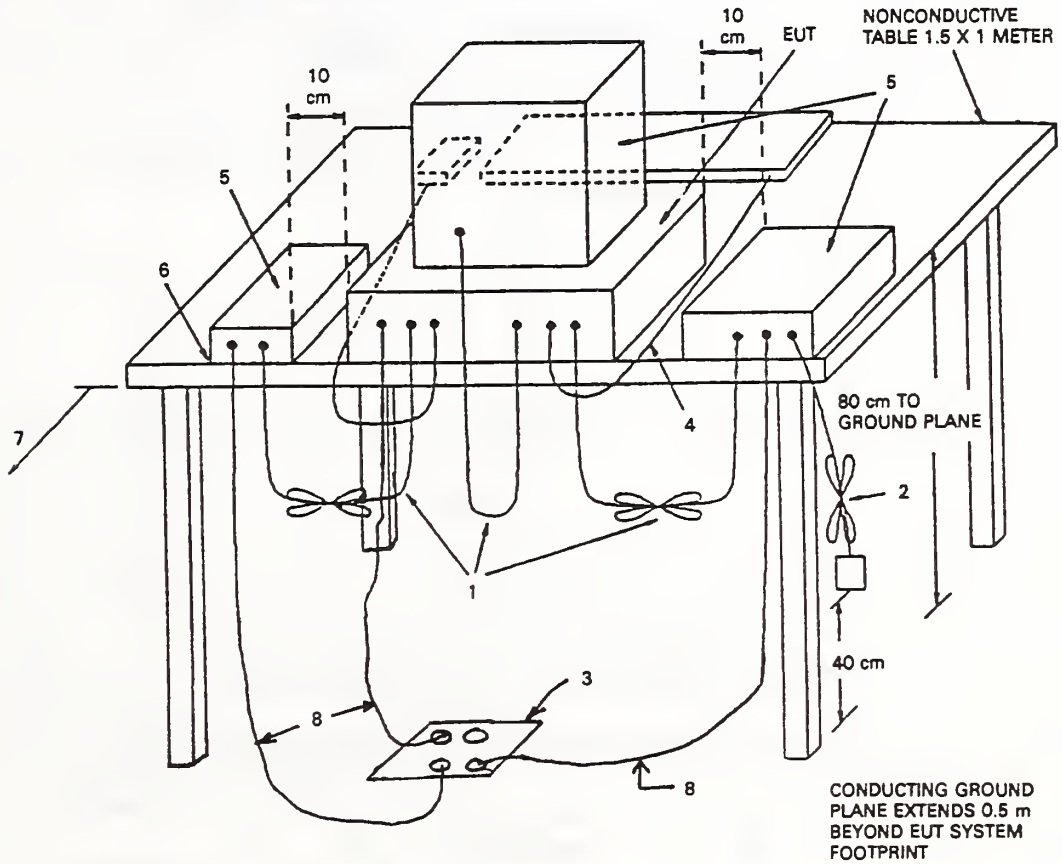
_____ 32. Is the test platform for a table top EUT 1 X 1.5 m in size and raised 80 cm above the ground plane?

_____ 33. Is there available site attenuation data in the form of graphs and tables for both horizontal and vertical polarizations?

_____ 34. Is the site attenuation data less than 1 year old?

_____ 35. Does this site attenuation data show compliance of this open area test site to the theoretical normalized site attenuation data within ± 4 dB?

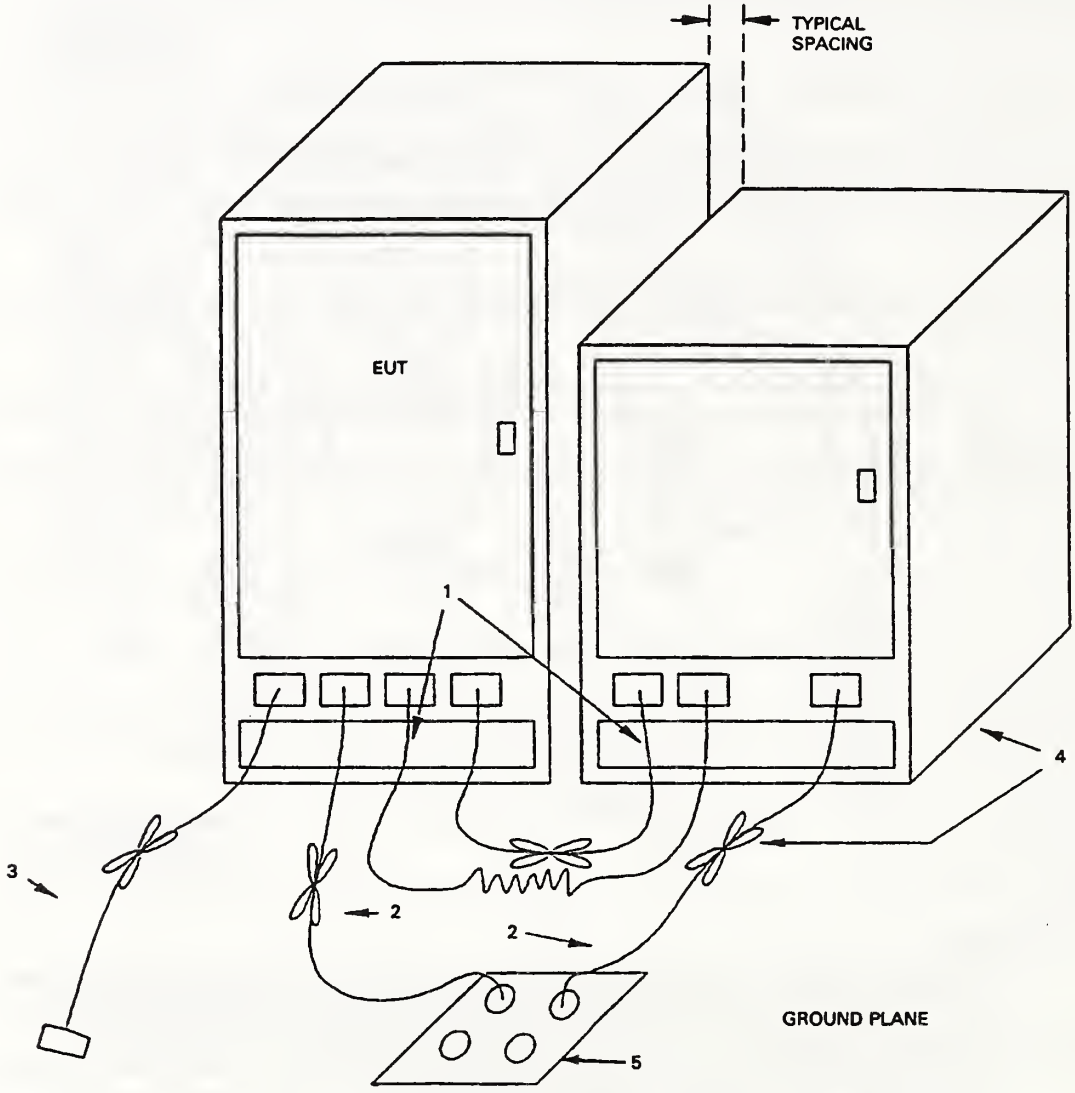
_____ 36. Are there unburied power and control cables present on the ground plane?



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components of EUT system being tested.
6. The rear of all components of the system under test shall be located flush with the rear of the table.
7. No vertical conducting wall used.
8. Power cords drape to the floor and are routed over to receptacle.

Figure 9(c). Test Configuration
Tabletop Equipment Radiated Emissions.



LEGEND:

1. Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion.
2. Excess power cords shall be bundled in the center or shortened to appropriate length.
3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.
4. EUT and all cables shall be insulated from ground plane by 3 to 12 mm of insulating material.
5. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.

Figure 9(d). Test Configuration
Floor-Standing Equipment Radiated Emissions.

_____ 37. Has there been any changes made to this test site since the last site attenuation was measured and recorded?

_____ 38. Are broadband antennas used for final compliance measurements?

_____ 39. Are tunable dipole antennas used to check emission levels found to be within or over the FCC specified limit?

III. OPERATING CONDITION & CONFIGURATION OF EQUIPMENT UNDER TEST

A. Operating Conditions of the EUT.

_____ 1. Is the EUT operated at nominal voltage and frequency and typical load conditions?

_____ 2. Are all EUT ports connected to and terminated into a device of typical usage?

_____ 3. If there are multiple ports of the same type; is each port connected to an additional cable to investigate the additive effect these cables have on EUT emissions?

_____ 4. Is this additive effect less than 2 dB?

_____ 5. For a table top EUT are excess length cables bundled in the center in a serpentine fashion using 30 to 40 cm lengths to maintain 40 cm height above the ground plane?

_____ 6. Are all cables of hand operated devices (keyboards, mice, etc,) placed as close as possible to the host?

_____ 7. Are all peripherals aligned with the rear of the test platform?

_____ 8. Is the power cord of the EUT bundled?

_____ 9. Is the power cord of the non-EUT equipment bundled?

_____ 10. Is the EUT grounded in accordance with intended use?

_____ 11. Is the table top EUT centered laterally on the test platform and set flush with the rear of the test platform?

_____ 12. Are accessories placed in a typical configuration with one accessory on each side of the EUT with a 10 cm separation as in Figure 11?

_____ 13. Is the "H" pattern generated by a software program running on the EUT and that this program exercises all the peripherals?

_____ 14. Are cables manipulated to determine the maximum or near-maximum emission level within the constraints of Figures 9(a, b, c, d) and 11?

_____ 15. Is a prescan area used for radiated and/or conducted emissions?

_____ 16. Is this prescan area used for full evaluation of CPU speeds, video modes, operational modes of the EUT, and cable maximization?

_____ 17. Is source substitution used to verify absolute emission level readings?

_____ 18. When using source substitution or direct measurement method of making emission readings; are all uncertainties of calibration accounted for and known?

IV. TEST REPORTS

A. Content of Test Reports.

_____ 1. Is the standard to which the EUT was tested clearly referenced in the test report?

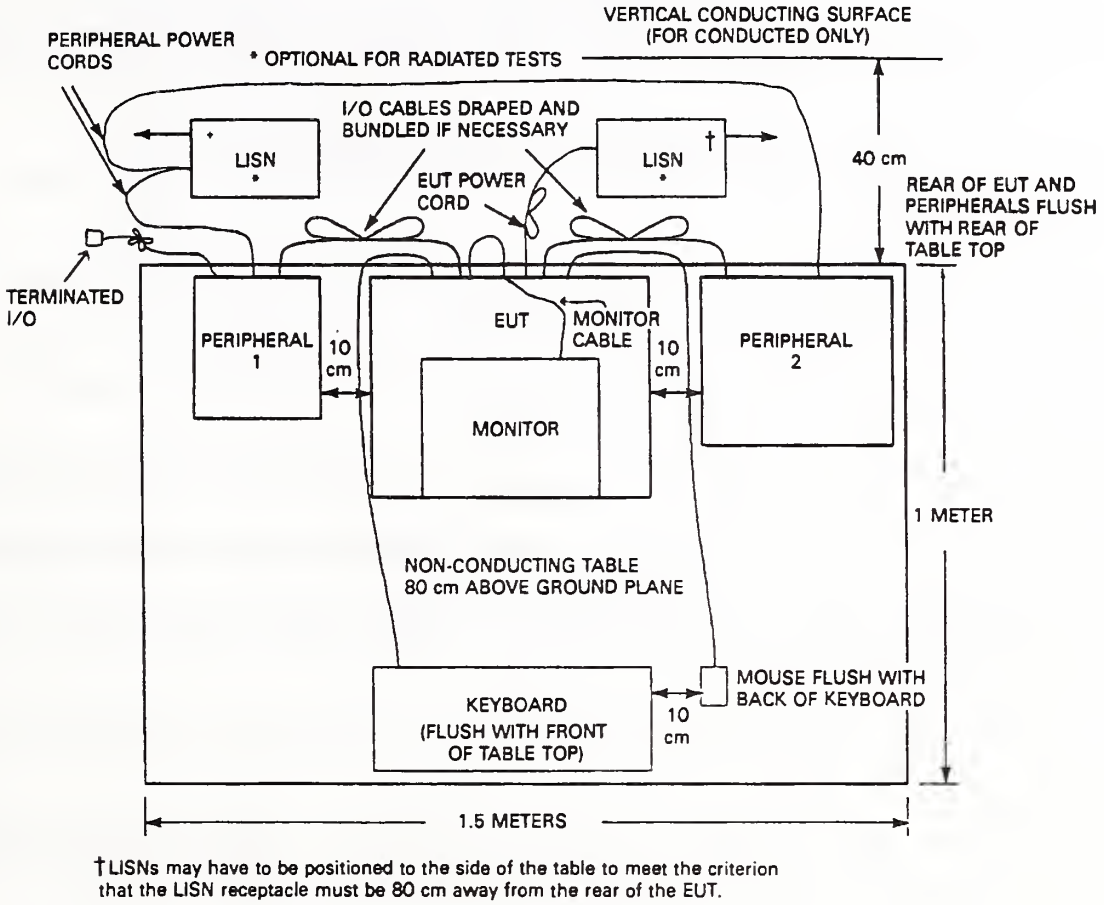
_____ 2. Is there a statement in the test report that the data in this report represents the worse case emissions?

_____ 3. Are all peripherals listed by manufacturer, model number, serial number and by FCC ID number?

_____ 4. Are all major subassemblies or internal peripherals listed by manufacturer, model number, serial number and by FCC ID number? Examples are hard drives, power supply, mother board, floppy drives, all internal circuit boards, etc.

_____ 5. Are there statements in the test report that completely describe the manufacture of the interconnecting cables? Detail should include shield type (braid or foil), how the shield is terminated and grounded (360 degree via metal backshells or drain wire).

_____ 6. Is a block diagram of the EUT test set up included in the test report?



†LISNs may have to be positioned to the side of the table to meet the criterion that the LISN receptacle must be 80 cm away from the rear of the EUT.

Figure 11. Test Configuration for Tabletop Equipment (Top View).

_____ 7. Are photographs of the EUT test set ups included in the test report?

_____ 8. Do these photographs show maximized emission configuration for both radiated and conducted tests?

_____ 9. Is a complete list of test equipment included in the test report with manufacturer's model number, serial number, date of last calibration, and calibration interval?

_____ 10. Are measurement cable loss, instrumentation bandwidth, detector function, and antenna factors included where applicable?

_____ 11. Are proper units of measure used; i.e., dB(uV/m) for radiated measurements and dB(uV) for conducted measurements?

_____ 12. Is the location of the test site listed in the test report?

_____ 13. Is measurement data presented in tabular or graphical form in the test report?

_____ 14. Are there at least six radiated and six conducted emission levels listed in the test report?

_____ 15. For conducted emission, is data listed for each power line; i.e., AC high and AC neutral?

_____ 16. Is there a brief summary of test results showing the worse case conducted and radiated emissions by frequency, by corrected signal level, specification limit, polarization of antenna, height of antenna, which AC power line, etc?

_____ 17. Is there a statement in the test report describing the modifications required to pass the limit?

_____ 18. Does the test report have signatures of the representative of the organization performing these tests?

_____ 19. Does the test report contain enough detail so that EUT testing can be replicated at another test lab?

_____ 20. Are the written test procedures for performing conducted and radiated emission testing included in the test report?

_____ 21. Are the Class A reports as detailed and exact as the Class B reports?

_____ 22. Does the report contain:
- frequency of emission
- antenna used, by type and serial number
- antenna height
- antenna distance to EUT
- antenna polarization
- index mark indicating degrees of rotation of turntable
- receiver attenuation
- meter reading
- corrected emission level
- date data was taken
- configuration of EUT

V. PERSONNEL AND TRAINING

1. How are radiated prescans performed?

2. How does the test person determine if the emission if from the EUT or an ambient?

3. How does the test person handle an emission that is close to an ambient?

4. How does the test person determine that the test instrumentation is not in overload?

5. Is this test facility used for performing emission tests to ANSI C63.4-1992 for FCC Part 15?

6. Is this test facility used for performing emission tests to CISPR 22-1993?

7. Is the test operator aware that if the conducted emission level is at least 6 dB less in the average detector mode than in the quasi-peak mode; then the quasi-peak level may be reduced by 13 dB and then compared to the limit? If the reduced level is below the limit, then the EUT is considered to have passed the limit.

8. Are coax cables, antennas, receiver or spectrum analyzer checked each morning for proper operation?

9. Is recalibration performed each time the test operator changes receiver frequency bands?

10. Is a graph generated each time a compliance test is performed to show the ambients?

11. Observe the test operator performing a conducted emission scan.

12. Observe the test operator performing a radiated emission scan.

13. Have test operator replicate three frequency points (60 MHz, 225 MHz and 750 MHz) on the horizontal site attenuation and three frequency points (30 MHz, 95 MHz, and 160 MHz) on the vertical site attenuation. Verify accuracy of these frequencies to previous recorded data.

ON-SITE CHECKLIST FOR FCC PART 15-DIGITAL DEVICES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

ON-SITE CHECKLIST FOR FCC PART 15-DIGITAL DEVICES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

APPENDIX D

SPECIFIC OPERATIONS CHECKLIST - FACILITY LISTING WITH FCC

NVLAP LAB CODE: [ ]

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FACILITY LISTING WITH FCC

This checklist is designed for use by a NVLAP Technical Expert(s) (TE) during the conduct of an on-site assessment for initial or renewal of accreditation. The checklist contains items from the NVLAP Program Handbook(s), 15 CFR Part 285-NVLAP Procedures and General Requirements, 47 CFR-Telecommunications-Part 2.948, ANSI C63, and other technical references. This checklist will be used in conjunction with other NVLAP checklists.

The completed checklist becomes a part of the laboratory ON-SITE ASSESSMENT REPORT which is used in the evaluation of the laboratory for granting or renewal of accreditation. Deficiencies noted in this checklist must be resolved in accordance with the NVLAP Procedures. Comments not specified as deficiencies may be directed to the laboratory by the TE.

Laboratory Name _____

NVLAP Technical Expert(s) _____

On-Site Dates _____

Facility and Test Site(s) Assessed _____

_____

Instructions to Laboratory

Respond in writing within 30 days of the date of this report, addressing all deficiencies documented by the assessor. Each deficiency must be referenced, in your response, by number as it is listed in the report.

This on-site assessment report conveys the opinion of the assessor as a single representative of NVLAP. The final evaluation of your laboratory for the purpose of recommending approval or denial of accreditation will be conducted by NIST evaluators who will review this report, the written information submitted by you, and results of any required proficiency testing. You must respond to this report by identifying the actions you have taken, or plan to take, to correct the deficiencies identified. Respond in detail so that an accurate evaluation can be completed. Failure to respond may delay an accreditation decision. Questions concerning this report should be directed to NVLAP.

The assessor has discussed the contents of this report with members of the laboratory management who agree to respond in writing to NIST, regarding resolution or correction of any deficiencies noted, within 30 days of the date of this report.

_____

Signature of Authorized Representative or designee | Printed Name | Date

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FACILITY LISTING WITH FCC

Summary of the NVLAP requirements for measurement facilities:

_____ The laboratory must meet all NVLAP general criteria as stated in NIST Handbook 150.

_____ The laboratory must meet all NVLAP technical criteria as stated in the program specific handbook.

_____ Laboratories shall keep at their facility appropriate, up-to-date files as part of their documentation system. The files must be covered by the laboratory quality system.

_____ Appropriate files shall be available upon request both to NVLAP and the Federal Communications Commission (FCC) per the FCC requirements for facility listing.

_____ The files shall be available for review by the NVLAP on-site assessor(s) during regular on-site or monitoring visits.

_____ Each radiated and line conducted emissions test site (including open area, anechoic chambers, and weather protected sites) that is used for FCC equipment authorization testing shall be included in the documentation.

_____ Antennas must be calibrated per ANSI C63.4 section 4.4.1 and ANSI C63.5. "Traceability is the property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties." (ISO VIM 1993)

Instructions to the Assessor: This checklist addresses specific criteria relating to FCC facility listing requirements.

Place an "X" beside any of the following items which represent a NVLAP deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments in this list or on the comment sheet(s).

Place a check beside all other items you observed or verified at the laboratory. All items must be marked.

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications Testing

ON-SITE CHECKLIST FOR FACILITY LISTING WITH FCC

_____ (a) Each party making measurements of equipment that is subject to an FCC equipment authorization under part 15 or part 18 of 47 CFR chapter I, regardless of whether the measurements are filed with the FCC or kept on file by the party responsible for compliance of equipment marketed within the United States or its possessions, shall compile a description of the measurement facilities employed.

_____ Laboratory procedures for compiling the required description and files are documented in the laboratory procedures manual.

_____ The laboratory has at its facility appropriate, up-to-date files as part of its documentation system. The process and records must be covered by the laboratory quality system.

_____ (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

_____ Does this laboratory retain such information?

_____ (i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the FCC by that laboratory. In this situation, the party responsible for verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

_____ (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

_____ (2) If the equipment is to be authorized by the FCC under the certification or the notification procedure, the description of the measurement facilities shall be filed with the FCC Laboratory in Columbia, MD. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this Section. At least every 3 years, the organization responsible for filing the data with the FCC shall certify that the data on file is current.

_____ (b) The description specified in (a) above shall contain the following information for each open area test site or equivalent used by the laboratory:

_____ (1) Location of the test site.

_____ (2) Physical description of the test site accompanied by photographs 8" x 10" in size. Smaller photographs may be used if they clearly show the details of the test site and are mounted on full size sheets of paper.

_____ (3) A drawing showing the dimensions of the site, physical layout of all supporting structures, and all structures within 5 times the distance between the measuring antenna and the device being measured.

_____ (4) Description of structures used to support the device being measured and the test instrumentation.

_____ (5) List of measuring equipment used. Include spectrum analyzer/receiver, coaxial cable, and antenna(s).

_____ (6) Information concerning the calibration of the measuring equipment, i.e., the date the equipment was last calibrated and how often the equipment is calibrated.

_____ (7) If desired, a statement as to whether the test site is available to do measurement services for the public on a fee basis.

_____ (8) Site attenuation data including actual measurements, antenna factors, calculations, mutual impedance correction factors, tabulations and plots.

For alternate test sites (including anechoic chambers and weather protected sites), see ANSI C63.4. For open area test sites that have modifications (e.g., lighting, fire detection, proximity to metal surfaces, metal objects, cars, etc.), alternate test site measurements may be required.

_____ Horizontal polarization (per ANSI C63.4)

_____ Vertical polarization (per ANSI C63.4)

_____ The laboratory has copies, readily available, of all applicable reference documents, including; ANSI C63.4, ANSI C63.5, and ANSI C63.7.

_____ (iii) This requirement does not apply to equipment that is not measured on an open field test site or equivalent (e.g., microwave sites are not included).

_____ (9) A description of the types of equipment intended to be measured or other information regarding the types of measurements that would be performed at test facility.

The capabilities of the laboratory must be documented and laboratory policy must state that the laboratories capabilities will not be exceeded.

Exceptions to standard or accepted test procedures must be documented.

_____ (c) Has the laboratory indicated to the FCC that it will perform measurement services for the public on a fee basis?

_____ (d) Have changes to sites, equipment, calibrations, etc. required in (b) above been made according to written laboratory policies and procedures and have the changes been appropriately documented?

_____ Has the laboratory certified to the FCC, at least every three years, that the data on file is current? Has this certification been documented?

_____ (e) Assessment of the calibration of test equipment is covered under other sections of the NVLAP On-Site Checklist series.

ON-SITE CHECKLIST FOR FACILITY LISTING WITH FCC

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

NVLAP LAB CODE: [ ]

ON-SITE CHECKLIST FOR FACILITY LISTING WITH FCC

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

APPENDIX E

SPECIFIC OPERATIONS CHECKLIST - FCC PART 68-ANALOG AND DIGITAL

NVLAP LAB CODE: _____

National Voluntary Laboratory Accreditation Program (NVLAP)
for
Electromagnetic Compatibility and Telecommunications
47 CFR (FCC) Part 68-Analog and Digital

ON-SITE CHECKLIST

Abstract

This checklist is designed for use by a NVLAP Technical Expert(s) (TE) during the conduct of an on-site assessment for initial or renewal of accreditation for FCC Part 68-Analog and Digital. The checklist contains items from the NVLAP Program Handbook, NVLAP Procedures, Telecommunications Industry Association publication TSB31A, and technical references. The checklist is patterned after TSB31A.

The completed checklist becomes a part of the laboratory ON-SITE ASSESSMENT REPORT which is used in the evaluation of the laboratory for granting or renewal of accreditation. Deficiencies noted in this checklist must be resolved in accordance with the NVLAP Procedures. Comments not specified as deficiencies may be directed to the laboratory by the TE.

Laboratory Name _____

NVLAP Technical Expert(s) _____

On-Site Dates _____

Instructions to Laboratory

Respond in writing within 30 days of the date of this report, addressing all deficiencies documented by the assessor. Each deficiency must be referenced, in your response, by number as it is listed in the report.

This on-site assessment report conveys the opinion of the assessor as a single representative of NVLAP. The final evaluation of your laboratory for the purpose of recommending approval or denial of accreditation will be conducted by NIST evaluators who will review this report, the written information submitted by you, and results of any required proficiency testing. You must respond to this report by identifying the actions you have taken, or plan to take, to correct the deficiencies identified. Respond in detail so that an accurate evaluation can be completed. Failure to respond may delay an accreditation decision. Questions concerning this report should be directed to NVLAP.

The assessor has discussed the contents of this report with members of the laboratory management who agree to respond in writing to NIST, regarding resolution or correction of any deficiencies noted, within 30 days of the date of this report.

Signature of Authorized Representative or designee	Printed Name	Date

FCC PART 68 CHECKLIST

1 PURPOSE

1.1 This checklist is designed for use by NVLAP Technical Expert(s) (TE) during the conduct of an on-site assessment for initial or renewal of accreditation for FCC Part 68 compliance testing. The checklist may contain items from the Program Handbook, NVLAP Procedures, and technical references.

The completed checklist becomes a part of the laboratory ON-SITE ASSESSMENT REPORT which is used in the evaluation of the laboratory for granting or renewal of accreditation. Deficiencies noted in this checklist must be resolved in accordance with the NVLAP Procedures. Comments not specified as deficiencies may be directed to the laboratory by the TE.

2 CHECKLIST ORGANIZATION

2.1 This checklist is patterned after the Test Requirements Matrix contained in the copyrighted TIA Telecommunications Systems Bulletin No. 31A (TSB31A), Part 68 Rationale and Measurement Guidelines, prepared by the EIA/TIA TR-41 Committee on Telephone Terminals.

2.2 The Matrix contained in Table 4.5-2 of TSB31A, covers sections 5 through 15 of that document and is reproduced herein by permission of the publisher. The checklist's section numbering scheme from sections 5 through 15 tracks sequentially the sections of TSB31A as they are applicable.

2.3 In order to facilitate tracking, wherever the material of a section or subsection of the TIA document is listed in the matrix but is not included in this checklist, the corresponding section or subsection number of the checklist is identified with "intentionally left blank."

2.4 Within each section, individual checklist items are identified by lower case letters in alphabetical order. Space is left after each checklist item for the assessor's comments.

3 REFERENCE DOCUMENTS

3.1 Beyond the QA manual and other documentation required of all NVLAP accredited laboratories, a quality Part 68 lab should possess a copy of the latest issue of the following documents:

_____ a) FCC Part 68-Connection of Terminal Equipment to the Telephone Network

_____ b) FCC Form 730 Application Guide-Registration of Telephone and Data Equipment. latest available version

_____ c) TIA TSB31A-Telecommunications Bulletin No. 31A-Part 68 Rationale and Measurement Guidelines

_____ d) UL1459-Standard for Telephone Equipment

_____ e) IEEE 1027-Standard Method for Measuring the Magnetic Field Intensity Around a Telephone Receiver

_____ f) UL 497A-Secondary Protection for Communication Circuits

_____ g) FCC Part 2-Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

_____ h) National Electrical Code

4 CONTINUING COMPLIANCE PROGRAM

4.1 Although it is the responsibility of the registrant to adhere to the FCC Part 68 Continuing Compliance Program, the engaging of an outside test facility for the initial Part 68 testing implies a degree of reliance upon, and therefore, responsibility on the part of the test lab for this function.

_____ a) Is the laboratory aware of the "6-month audit" requirements; i.e., the need to perform all of the applicable Part 68 test (other than environmental) on a current production line model every 6 months?

_____ b) Is the laboratory aware that if in the previous 6 months, the equipment has experienced environmentally-caused failures that the environmental tests must also be performed as part of the audit?

_____ c) Does the laboratory inform the client of the Continuing Compliance Requirements in its initial report?

Reproduced from the
Telecommunications Industry Association's
publication TSB31A
Part 68 Rationale and Measurement Guidelines
by permission of the publisher

Table 4.5-2. Test Requirements Matrix

PART 68 REQUIREMENT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
5. ENVIRONMENTAL SIMULATION 68.302																	
5.2 Vibration 68.302(a)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5.3 Temperature and Humidity 68.302(b)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5.4 Mechanical Shock 68.302(c)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5.5 Metallic Voltage Surge (800 V) 68.302(d)	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x
5.6 Longitudinal Voltage Surge (1500 V) 68.302(e)(1) and (2)	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x
5.7 Longitudinal Voltage Surge (2500 V) 68.302(e)(3) NOTE 1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6. LEAKAGE CURRENT LIMITATIONS (ANALOG AND DIGITAL) 68.304 NOTE 2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7. HAZARDOUS VOLTAGE LIMITATIONS 68.306																	
7.1 Message Register Leads 68.306(a)(1)									x								
7.2 Automatic Identified Outward Dialing Leads 68.306(a)(2)										x							
7.3 Transient Voltages, MR 68.306(a)(3)									x								
7.4 Transient Voltages, AIOD 68.306(a)(3)										x							
7.5 E&M Leads 68.306(a)(4) and (5)				x	x	x											
7.6 OPS Voltage 68.306(a)(6)							x										
7.7 LADC Current and Voltage 68.306(a)(7)								x									
7.8 Ringdown/Metallic Private Lines 68.306(a)(8)											x						
7.9 Physical Separation of Leads 68.306(b)(1)	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x
7.10 Hazardous Voltage Protection 68.306(b)(2),(3),(4) and (c)	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x
7.11 Ringing Source Limitations 68.306(d)							x										
8. SIGNAL POWER LIMITATIONS 68.308 NOTE 3																	
8.1 Voiceband Signal Power 68.308(b)(1)	x	x	x	x	x	x	x			x	x						
8.2 Voiceband Signal Power Limiting Circuits 68.308(b)(1)	x	x	x	x	x	x	x			x	x						
8.3 Voiceband Signal Power - Network Control Signals 68.308(b)(2)	x	x	x	x	x	x											
8.4 DC Conditions for Through Transmission (On Premise) 68.308(b)(3)(i)	x	x	x	x	x	x	x										
8.5 Data Equipment Connections For Through Transmission 68.308(b)(3)(ii)	x	x	x	x	x	x	x										
8.6 Voiceband Signal Power - Data 68.308(b)(4)	x	x	x	x	x	x	x										
8.7 Voiceband Signal Power - Data Protective Circuitry 68.308(b)(4)	x	x	x	x	x	x	x										
8.8 Through Transmission Amplification 68.308(b)(5)(i)(A)-(G)	x	x	x	x	x	x	x					x		x	x		x
8.9 Through Transmission - SF Cutoff 68.308(b)(5)(i)(H)	x	x	x	x	x	x	x					x		x	x		x
8.10 Through Transmission - SF/Guard Bands 68.308(b)(5)(ii)	x	x	x	x	x	x	x					x		x	x		x
8.11 Return Loss - Two Wire 68.308(b)(6)(i)				x	x	x											
8.12 Return Loss - Four Wire 68.308(b)(6)(ii) and (iii)				x	x	x											
8.13 Transducer Loss - Four Wire 68.308(b)(6)(ii) and (iii)				x	x	x											
8.14 DC Conditions for OPS Ports 68.308(b)(7)							x										
8.15 Signal Power 3995 Hz - 4005 Hz 68.308(c)	x	x	x	x	x	x	x										
8.16 Voiceband Longitudinal Voltage - 0.1 kHz to 4 kHz 68.308(d)	x	x	x	x	x	x	x			x	x						
8.17 NonLADC Metallic Voltage - 4 kHz to 6 MHz 68.308(e)(1)	x	x	x	x	x	x	x			x	x						
8.18 NonLADC Longitudinal Voltage - 4 kHz to 6 MHz 68.308(e)(2)	x	x	x	x	x	x	x			x	x						
8.19 LADC Metallic Voltage - 0.01 kHz to 6 MHz 68.308(f)(1) and (2)								x									
8.20 LADC Longitudinal Voltage - 0.01 kHz to 6 MHz 68.308(f)(3)								x									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q

Reproduced from the
Telecommunications Industry Association's
publication TSB31A
Part 68 Rationale and Measurement Guidelines
by permission of the publisher

Table 4.5-2 Test Requirements Matrix (cont'd)

PART 68 REQUIREMENT		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
9. LONGITUDINAL BALANCE LIMITATIONS 68.310																		
9.1 Analog		X	X	X				X				X						
9.2 Digital														X	X		X	X
10. ON HOOK IMPEDANCE LIMITATIONS 68.312																		
10.1 DC Resistance 68.312(b)(1)(i) and (ii)		X																
10.2 DC Current During Ringing 68.312(b)(1)(iii) and (c)(1)		X	X															
10.3 AC Impedance During Ringing 68.312(b)(1)(iv),(v) and (c)(2)		X	X															
10.4 REN Calculation 68.312(d)-(g)		X	X															
10.5 DID Signaling And OPS Ringing 68.312(h)				X				X										
10.6 Message Registration 68.312(i)										X								
10.7 Voice Band Private Lines 68.312(j)												X						
10.8 Make Busy 68.312(k)		X																
11. BILLING PROTECTION 68.314	NOTE 3																	
11.1 Call Duration for Data Protective Circuitry 68.314(a)(1)	NOTE 4	X	X	X	X	X	X					X						
11.2 Call Duration for Data Equipment 68.314(a)(2)		X	X	X	X	X	X					X						
11.3 On-hook Signal Requirements 68.314(b)		X	X	X	X	X	X					X						
11.4 Loop Current Requirements 68.314(c)		X	X															
11.5 Signaling Interference 68.314(d)		X	X	X								X						
11.6 AICD Operating Requirements 68.314(e)											X							
12. HEARING AID COMPATIBILITY 68.316	NOTE 5																	
13. DIGITAL TERMINAL EQUIPMENT	NOTE 6																	
13.1 Subrate Pulse Repetition Rate 68.308(h)(1)(i)	NOTE 7												X	X	X			
13.2 Subrate Pulse Template 68.308(h)(1)(ii)														X	X			
13.3 Subrate Average Power 68.308(h)(1)(iii)														X	X			
13.4 Subrate Encoded Analog Content 68.308(h)(1)(iv)	NOTE 8												X		X			
13.5 Subrate Signaling Interference 68.314(d)(2)													X		X			
13.6 Subrate On-Hook Level 68.314(f)													X		X			
13.7 1.544 Mb/s Pulse Repetition Rate 68.308(h)(2)(i)	NOTE 9															X	X	X
13.8 1.544 Mb/s Pulse Template 68.308(h)(2)(ii)																	X	X
13.9 1.544 Mb/s Output Power 68.308(h)(2)(iv)																	X	X
13.10 1.544 Mb/s Encoded Analog Content 68.308(h)(2)(v)	NOTE 10															X		X
13.11 1.544 Mb/s Signaling Interference 68.314(d)(2)																X		X
13.12 1.544 Mb/s On-Hook Level 68.314(f)																X		X
13.13 1.544 Mb/s Signaling Duration 68.314(g)																	X	X
13.14 1.544 Mb/s Minimum Pulse Density and Keep Alive 68.318(b)(1)																	X	X
14. MISCELLANEOUS																		
14.1 Limitations on Automatic Redialing 68.318(c)		X																
15. SIX AND EIGHT POSITION MINIATURE PLUGS AND JACKS 68.500	NOTE 9																	
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q

5 ENVIRONMENTAL SIMULATION

5.1 intentionally left blank

5.2 *Vibration*

_____ a) Do the Manufacturer's Specifications for the shaker table clearly indicate its Part 68 testing capabilities; i.e., accelerations of 0.5 g peak from 5 Hz to 100 Hz and 1.5 g peak for 100 Hz to 500 Hz, at sweep rates 0.1 and 0.25 octaves per min., respectively, when loaded with the EUT?

_____ b) Are vibration tests performed with the EUT fully packaged for shipment with normally accompanying accessories, documentation, etc.?

5.3 *Temperature and Humidity*

_____ a) Do the Manufacturer's Specifications for the temperature and humidity chamber clearly indicate its Part 68 testing capabilities; i.e., temperature range of -40 °F (-40 °C) to 150 °F (65.6 °C) and a humidity range of up to 95% relative humidity, with an accuracy of ±5 °F (±3 °C) and ±10% relative humidity?

5.4 *Mechanical Shock*

_____ a) Is an asphalt tile covered concrete surface available for the shock tests?

_____ b) Are shock tests performed unpackaged?

_____ c) Is mechanical drop equipment available for heavier than "portable" EUT?

_____ d) Are drop tests performed for each required orientation of the EUT?

_____ e) Does tester appreciate the required EUT weight vs. required test drop height relationships?

5.5, 5.6, and 5.7 *Surge Tests*

NOTE: The following checklist items apply to all three types of surges covered in sections 5.5, 5.6 and 5.7 below.

_____ a) Are photos of current waveforms on file?

_____ b) Is date of current waveform representations more recent than one year?

_____ c) Is surge generator capable of producing surges of both polarities for all three voltages, 800, 1500, and 2500 V?

_____ d) Is the surge generator's working state verified before each use or at least at the beginning of each test day?

5.5 *Metallic Voltage Surge (800 V)*

_____ a) Are the pulse characteristics as follows: open circuit voltage 800 V peak; maximum rise time to crest 10 μs; minimum decay time to half crest 560 μs; peak current capability 100 A minimum for all cases except simplexed pairs; and 200 A minimum for simplexed pairs?

5.6 *Longitudinal Voltage Surge (1500 V)*

_____ a) Are the pulse characteristics as follows: open circuit voltage 1500 V peak; maximum rise time to crest 10 μs; minimum decay time to half crest 160 μs; and peak current capability 200 A minimum?

5.7 *Longitudinal Voltage Surge (2500 V)*

_____ a) Are the pulse characteristics as follows: maximum rise time to crest 2 μs; minimum decay time to half crest 10 μs; and peak current capability 1000 A minimum?

6 LEAKAGE CURRENT LIMITATIONS

_____ a) Is 60 Hz source capable of producing 1000 V and 1500 V and a current of at least 10 mA peak?

_____ b) Is the voltage ramped up over a 30 second period and allowed to stay at the maximum voltage for an additional 60 seconds?

_____ c) When the EUT contains line relay contacts on the network side of the dielectric barrier, are provisions made to close these contacts, artificially, if necessary, without affecting the current path?

_____ d) For the 1500 V EUT to power line barrier test is the EUT's power switch turned on?

7 HAZARDOUS VOLTAGE LIMITATIONS

7.1 through 7.8

NOTE: The following checklist items refer to the availability of test equipment required for one or more of the types of EUT covered in TSB31A sections 7.1 through 7.8.

_____ a) Is a dc voltmeter with: an input impedance >1 megohm; a range of 0-200 V; and an accuracy of $\pm 3\%$ available?

_____ b) Is a true rms ac voltmeter with: an input impedance >100 kohms; a frequency range of 1 kHz to at least 1 MHz; an input sensitivity of at least 35 mV or better (referenced to 135 ohms); peak voltage and rms voltage indicating; and an accuracy of $\pm 3\%$ available?

_____ c) Is a digital sampling storage oscilloscope with: input impedance >1 Mohm; frequency range >6 MHz; input sensitivity of 3 mV or better; trigger sensitivity of at least 10 mV or better; and an accuracy of $\pm 3\%$ available?

7.9 *Physical Separation of Leads*

_____ a) Is tester fully aware of the physical separation of network interface, power, and hazardous voltage lead requirements?

7.10 *Hazardous Voltage Protection*

_____ a) Is voltage source of 120 V rms 60 Hz with output current of 20 A continuous and 50 A for 1 minute capability available?

_____ b) Is voltage source of 300 V rms 60 Hz with output current of 20 A continuous and 50 A for 1 minute capability available?

_____ c) Are terminating resistors of 750, 1000, and 1500 ohms in their proper voltage divider configuration available?

7.11 intentionally left blank

8 SIGNAL POWER LIMITATIONS

8.1 *Voiceband Signal Power*

_____ a) Is a true rms ac voltmeter with 3 second averaging capability used?

_____ b) Is a bandpass filter with: input impedance >100 kohms; bandpass 200 to 4 kHz (3 dB points); and out-of-band rolloff >24 dB per octave used?

8.2 *Voiceband Signal Power Limiting Circuits*

_____ a) Are output signals measured at a minimum of five frequencies in the voice band?

8.3 *Voiceband Signal Power - Network Control Signals*

_____ a) Are signal power measurements made at minimum and maximum loop currents?

8.4 *DC Conditions for Through Transmission*

NOTE: In this instance, this question is used to determine whether the laboratory's own loop simulator circuit meets the requirements specified in Part 68 Fig. 68.3.

_____ a) Can it be demonstrated that the laboratory's loop simulator circuit contains a continuously variable resistance of 400 to 1740 ohms for loop start applications and 400 to 2450 ohms for ground start applications?

8.5 intentionally left blank

8.6 *Voiceband Signal Power - Data*

_____ a) For programmed data equipment, are signal power measurements made with each value of programming resistor; i.e., 0, 150, 336, 569, 866, 1240, 1780, 2520, 3610, 5490, 9200, 19800 ohms and open circuit?

8.7 *Voiceband Signal Power - Data Protective Circuitry*

_____ a) For EUT's equipped with a programmable jack configuration, are measurements made for all values of the programming resistor?

8.8 intentionally left blank

8.9 intentionally left blank

8.10 intentionally left blank

8.11 *Return Loss - 2-Wire*

_____ a) Is a reference network comprising a 600 ohm resistor in series with a 2.16 μF capacitor available?

8.12 intentionally left blank

8.13 intentionally left blank

8.14 intentionally left blank

8.15 *Signal Power 3995 Hz to 4005 Hz*

_____ a) Is a 10 Hz bandpass filter having the following characteristics: input impedance >100 kohms; bandpass 3995 Hz to 4005 Hz, cutoff frequencies at the 3 dB points; and out-of-band rolloff >24 dB per octave available?

8.16 *Voiceband Longitudinal Voltage 0.1 kHz to 4 kHz*

_____ a) Is an appropriate weighting filter as described in Fig. 68.308(a) of Part 68 used for this measurement?

_____ b) Is the 600 ohm metallic/500 ohm longitudinal termination available for this measurement?

_____ c) Is a true rms voltmeter capable of averaging over 0.1 s available for making this measurement?

_____ d) Is the ±3.1 dB voltage divider effect correction applied to the raw measurement before submitting application?

8.17 *Non-LADC Metallic Voltage 4 kHz to 6 MHz*

_____ a) Are the resistive terminations of 300 and 135 ohms available for these measurements?

8.18 *Non-LADC Longitudinal Voltage 4 kHz to 6 MHz*

_____ a) Are the resistive terminations for 300 ohms metallic/500 ohms longitudinal and 135 ohms metallic/90 ohms longitudinal available for these measurements?

_____ b) Is the +1.4 dB correction for the voltage divider effect applied to the raw data prior to submitting the application (4 kHz to 12 kHz)?

_____ c) Is the +4 dB correction for the voltage divider effect applied to the raw data prior to submitting the application (12 kHz to 6 MHz)?

8.19 intentionally left blank

8.20 intentionally left blank

9 LONGITUDINAL BALANCE

9.1 *Analog EUT*

NOTE: Items 9.1.1, 2, 3, 4, and 7 are also applicable to the *Digital* section.

_____ a) Is EUT properly configured, i.e., all normal ground paths connected tot he ground plane, such as ac power ground, water pipe ground, metallic exposed surface, connections to other equipment through which ground may be introduced?

_____ b) Is all test equipment, i.e., battery feed supply (if required), connecting cables, etc. as well as the 600 ohm or other termination, included in the bridge calibration procedure?

_____ c) Are all balance measurements made with T&R normal and T&R transposed?

_____ d) Is ground plane of sufficient area (50% greater than EUT "footprint") on which to rest ungrounded EUT available?

_____ e) Are off-hook measurements made with more than one magnitude of loop current?

_____ f) In the voice frequency band, can the bridge be balanced to 80 dB for 200 to 1000 Hz and 60 dB for 1000 to 4000 Hz?

_____ g) If an IEEE (L-M) method bridge is used, is EUT impedance measured to determine proper magnitude of correction factor to be applied to the measurement before submitting application?

_____ h) Is this correction factor -3 dB for the voice band (at 600 ohms)?

9.2 *Digital EUT*

_____ a) Can the M-L (FCC) method digital L.B. bridge be calibrated to 55 dB balance?

_____ b) If an IEEE (L-M) method bridge is used, can the bridge be calibrated to exceed 55 dB, enough to account for the large conversion factors required?

_____ c) Is balance measurement performed on both pairs?

10 ON HOOK IMPEDANCE LIMITATIONS

10.1 *DC Resistance*

_____ a) If EUT is externally powered, are dc resistance measurements made in both, the powered and unpowered states?

_____ b) Are measurements made at least at 10, 20, 50, 100 and 200 V?

_____ c) Are these measurements made for both polarities?

_____ d) Are measurements also made from Tip to Ground and Ring to Ground for several voltages and both polarities?

_____ e) Is internal resistance of measuring equipment taken into account?

10.2 *DC Current During Ringing*

_____ a) Is dc voltage 56.5 V?

_____ b) Are measurements made at the lowest, highest, and one or more intermediate ringing frequencies for the particular ringing type (three intermediate frequencies for "B" type ringers)?

_____ c) Are measurements made at least at the lowest and highest ac voltage at each frequency for the particular ringing type?

_____ d) Are measurements in "10.2.1" and "10.2.2" above also made with the Tip and Ring transposed?

10.3 *AC Impedance During Ringing*

_____ a) Is dc voltage 56.5 V?

_____ b) Are measurements made at the lowest, highest, and one or more intermediate ringing frequencies for the particular ringing type (three intermediate frequencies for "B" type ringers)?

_____ c) Are measurements made at least at the lowest and highest ac voltage at each frequency for the particular ringing type?

_____ d) Are measurements in "10.3.1" and "10.3.2" above also made with the Tip and Ring transposed?

10.4 *REN Calculation*

_____ a) In calculating DC REN are data from the dc resistance measurements (without applied ac) used?

10.5 *DID Signaling and OPS Ringing*

_____ a) Is the ringing "load" selected to simulate the PBX's maximum number of stations as specified by the PBX manufacturer?

10.6 *Message Registration*

_____ a) Are resistance measurements made from Tip to Ground to Ring to Ground for both polarities?

10.7 *Voiceband Private Lines*

_____ a) Are measurements made at least at five voltages from 10 V to 200 V?

_____ b) Are measurements made for both polarities?

10.8 *Make Busy*

_____ a) Is the EUT evaluated to determine that it does not go off-hook for purposes other than initiating or receiving a call?

11 BILLING PROTECTION

11.1 intentionally left blank

11.2 *Call Duration for Registered Terminal Equipment for Data Applications*

_____ a) Can the capabilities of the digital sampling oscilloscope used for making these measurements be demonstrated?

_____ b) Can the identification of any allowable signals appearing before two seconds of off-hook time be demonstrated?

11.3 *On-hook Signal Requirements*

_____ a) When measuring the output signal power is the EUT placed in all of its normal inactive states, such as its various "housekeeping" routines, if any?

11.4 intentionally left blank

11.5 *Signaling Interference*

_____ a) Do the 800 Hz to 2450 Hz and 2450 Hz to 2750 Hz bandpass filters have the following characteristics: input impedance $\geq$100 kohms; cut-off frequencies at the 3 dB attenuation pints; and out-of-band rolloff $\geq$24 per octave?

11.6 intentionally left blank

12 HEARING AID COMPATIBILITY

_____ a) Can evidence of the Helmholtz coil calibration of the probe coils be produced?

_____ b) Are any correction factors resulting from the calibrations applied to the measurements?

_____ c) Does the HAC test fixture permit the proper coupling and orientation of the EUT's receiver to make measurements as prescribed in Part 68 (and EIA RS-504-1983)?

13 DIGITAL TERMINAL EQUIPMENT

13.1 *Subrate Pulse Repetition Rate*

_____ a) Is test performed for each of the data rates at which the EUT is capable of operating?

13.2 *Subrate Pulse Template*

_____ a) Is the data generator used in this test capable of causing the EUT to transmit a signal which will allow the capture of a single pulse; i.e., with a minimum of one leading and one trailing zero?

_____ b) Is the lab equipped with the proper template to verify the results of this measurement?

13.3 *Subrate Average Power*

_____ a) Is measurement made at all of the transmission rates?

_____ b) Are the measurements made with 135 ohm termination and, if not, is correction applied to the results?

_____ c) Is averaging done over at least 3 seconds?

13.4 *Subrate Analog Content*

_____ a) Is power measured using a 600 ohm termination?

_____ b) Is power averaged over 3 seconds?

13.5 *Subrate Signaling Interference*

_____ a) Is the test performed for each of the EUT's generated signals?

13.6 *Subrate On-hook Level*

_____ a) Are readings taken in dBm with respect to 600 ohms?

13.7 *1.544 Mb/s Pulse Repetition Rate*

_____ a) Are both the transmit and receive pairs terminated properly in 100 ohms?

13.8 *1.544 Mb/s Pulse Template*

_____ a) Is the data generator used in this test capable of causing the EUT to transmit a signal which will allow the capture of a single pulse; i.e., with a minimum of one leading and one trailing zero?

_____ b) Is the lab equipped with proper templates to verify the results of all three of these measurements?

13.9 *1.544 Mb/s Output Power*

_____ a) Are output power measurements made for all three pulse options; i.e., 0 dB, 7.5 dB and 15 dB loss at 772 kHz?

_____ b) If an "all ones" signal is not possible, are the necessary corrections made to the data based on the pulse density used?

13.10 *1.544 Mb/s Encoded Analog Content*

_____ a) Is power measured using a 600 ohm termination?

_____ b) Is power averaged over 3 seconds?

13.11 *1.544 Mb/s Signaling Interference*

_____ a) Is the test performed for each of the EUT's generated signals?

13.12 *1.544 Mb/s On-hook Level*

_____ a) Are readings taken in dBm with respect to 600 ohms?

13.13 *Signaling Duration*

_____ a) is the minimum five-second interval measured as opposed to estimated?

13.14 intentionally left blank

14 MISCELLANEOUS

14.1 *Limitations on Automatic Redialling*

_____ a) Is the person responsible for testing versed in the details of the limitations such as the number of times redialling is allowed and which types of equipment are exempt from this requirement?

15 intentionally left blank

16 FAILURE ANALYSIS

16.1 Failure Analysis Program

_____ a) Does the laboratory have a failure analysis program as suggested in Appendix F of the Form 730 Application Guide (12/7/92 version and later)?

_____ b) Are records of test failures kept for statistical studies? Have statistical studies been conducted?

_____ c) Are the laboratory failure analysis program and records adequate?

FCC PART 68 CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X". If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

FCC PART 68 CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X". If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

APPENDIX F

PROGRAM-SPECIFIC APPLICATION FORM

NVLAP LAB CODE: _____

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS TEST METHOD SELECTION LIST - FCC TEST METHODS

Instructions: Check each test method for which you are requesting accreditation.

FCC TEST METHODS for 47 CFR PART 15 AND PART 68

	NVLAP Code	*Test Method Designation*
_____	12/C01	Conducted Emissions, Power Lines, 450 KHz to 30 MHz FCC Method - 47 CFR Part 15 - Digital Devices
_____	12/R01	Radiated Emissions FCC Method - 47 CFR Part 15 - Digital Devices
_____	12/T01	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.302 Environmental simulation, Para. c, d, e, f 68.304 Leakage current limitations 68.306 Hazardous voltage limitations 68.308 Signal power limitations 68.310 Longitudinal balance limitations 68.312 On-hook impedance limitations 68.314 Billing protection
_____	12/T02	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.316 Hearing Aid Compatibility: Technical standards
_____	12/T03	Terminal Equipment Network Protection Standards FCC Method - 47 CFR Part 68 - Analog and Digital 68.302 Environmental simulation, Para. a, b

TOTAL NUMBER OF TEST METHOD OPTIONS SELECTED:

A. If you selected 12/C01 and/or 12/R01, enter "1" on Line A — Line A _____

B. If you selected 12/T01 and/or 12/T02 and/or 12/T03, enter "1" on Line B — Line B _____

C. Add Lines A and B. Enter the total here and on Line 5b of the Fee Calculation Worksheet for FCC Test Methods — Line C _____

Complete the Application Supplement on the following pages.

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS APPLICATION SUPPLEMENT - FCC TEST METHODS

QUALITY ASSURANCE MANUAL:

Before the initial on-site assessment and for renewals requiring an on-site assessment, please provide NVLAP with a copy of the laboratory quality manual. The manual may accompany this application or may be sent at a later date. The NVLAP on-site assessor(s) will review the manual *before conducting* the on-site assessment of the laboratory and return it afterwards.

12/C01 - CONDUCTED EMISSIONS

Provide the name of the manufacturer and model of **one representative instrument** of each type which the assessor may closely examine during the on-site visit. Describe any of the instruments which are special, modified, or custom designed. Indicate the total number of like or similar instruments used to conduct this test.

Instrument: EMI Meter, Spectrum Analyzer, CISPR Quasi-Peak Detector, Peak Detector

12/R01 - RADIATED EMISSIONS

Provide the name of the manufacturer and model of **one representative instrument** of each type which the assessor may closely examine during the on-site visit. Describe any of the instruments which are special, modified, or custom designed. Indicate the total number of like or similar instruments used to conduct this test.

Instrument: EMI Meter, Spectrum Analyzer, CISPR Quasi-Peak Detector, Peak Detector

Give the geographical location of the test site(s). How far is it from the laboratory site? Is the site(s) currently on the FCC facility listing per 47 CFR Part 2.948?

12/T01 - TERMINAL EQUIPMENT NETWORK PROTECTION STANDARDS

Provide the name of the manufacturer and model of **one representative instrument** of each type which the assessor may closely examine during the on-site visit. Describe any of the instruments which are special, modified, or custom designed. Indicate the total number of like or similar instruments used to conduct this test.

Instrument: Surge Generator, True RMS Voltmeter, DC Voltmeter, DC Ammeter, Balance Test Set, Ringing Generator, AC Voltmeter, AC Power Supply or Leakage Current Test Set, DC Power Supply, Loop Simulator, Weighting Circuits, Analyzer, Oscillator (Amplifier), Filter, Vibration Table, Environmental Chamber

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS APPLICATION SUPPLEMENT - FCC TEST METHODS

12/T02 - TERMINAL EQUIPMENT NETWORK PROTECTION STANDARDS

Provide the name of the manufacturer and model of **one representative instrument** of each type which the assessor may closely examine during the on-site visit. Describe any of the instruments which are special, modified, or custom designed. Indicate the total number of like or similar instruments used to conduct this test.

Instrument: Bandpass Filter, Feed Circuit, Helmholtz Coil, Level Recorder, Oscillator, Probe Coil, True RMS Voltmeter

*U.S. GOVERNMENT PRINTING OFFICE: 1995-386-627/37923

NIST Technical Publications

Periodical

Journal of Research of the National Institute of Standards and Technology—Reports NIST research and development in those disciplines of the physical and engineering sciences in which the Institute is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Institute's technical and scientific programs. Issued six times a year.

Nonperiodicals

Monographs—Major contributions to the technical literature on various subjects related to the Institute's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NIST, NIST annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a worldwide program coordinated by NIST under the authority of the National Standard Data Act (Public Law 90-396). NOTE: The Journal of Physical and Chemical Reference Data (JPCRD) is published bimonthly for NIST by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements are available from ACS, 1155 Sixteenth St., NW, Washington, DC 20056.

Building Science Series—Disseminates technical information developed at the Institute on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NIST under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The standards establish nationally recognized requirements for products, and provide all concerned interests with a basis for common understanding of the characteristics of the products. NIST administers this program in support of the efforts of private-sector standardizing organizations.

Order the **following** *NIST publications—FIPS and NISTIRs—from the National Technical Information Service, Springfield, VA 22161.*

Federal Information Processing Standards Publications (FIPS PUB)—Publications in this series collectively constitute the Federal Information Processing Standards Register. The Register serves as the official source of information in the Federal Government regarding standards issued by NIST pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

NIST Interagency Reports (NISTIR)—A special series of interim or final reports on work performed by NIST for outside sponsors (both government and nongovernment). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service, Springfield, VA 22161, in paper copy or microfiche form.

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
National Voluntary Laboratory Accreditation Program (NVLAP)
Building 411, Room A162
Gaithersburg, MD 20899

Official Business

Penalty for Private Use $300

FORWARDING AND RETURN POSTAGE GUARANTEED
ADDRESS CORRECTION REQUESTED

BULK RATE
POSTAGE & FEES PAID
NIST
PERMIT NO. G195